DRAFT COPY F16

(19) Japanese Patent Office (12) Publication of Unexamined Patent Applications (A) (11) Unexamined Patent Publication Number
Unexamined Japanese Patent No. H07-250812

(43) Publication Date: October 3, Heisei 7 (1995)

(51) Int. Cl. [6]	Identification Symbol		FI
A61B 1/04	370		
1/00	300	D	
		E	
		T	

Request for Examination: Examination not requested Number of Claims: 1 OL (10 pages total)

(21) Application Number H06-44462

(22) Date of Filing March 15, Heisei 6 (1994)

(71) Applicant 000000376
Olympus Optical Co. Ltd.
2-43-2 Hatagaya, Shibuya-ku, Tokyo

(72) Inventor Mamoru KANEKO
at Olympus Optical Co. Ltd.
2-43-2 Hatagaya, Shibuya-ku, Tokyo

(72) Inventor Sakae TAKEHATA
at Olympus Optical Co. Ltd.
2-43-2 Hatagaya, Shibuya-ku, Tokyo

(72) Inventor Masaya YOSHIHARA
at Olympus Optical Co. Ltd.
2-43-2 Hatagaya, Shibuya-ku, Tokyo

(72) Inventor Masahiko IIDA
at Olympus Optical Co. Ltd.
2-43-2 Hatagaya, Shibuya-ku, Tokyo

(72) Inventor Yasuhiro UEDA
at Olympus Optical Co. Ltd.
2-43-2 Hatagaya, Shibuya-ku, Tokyo

(72) Inventor Yukimine KOBAYASHI
at Olympus Optical Co. Ltd.
2-43-2 Hatagaya, Shibuya-ku, Tokyo

(72) Inventor Kazunari NAKAMURA
at Olympus Optical Co. Ltd.
2-43-2 Hatagaya, Shibuya-ku, Tokyo

(72) Inventor Yoshinao OOAKI
at Olympus Optical Co. Ltd.
2-43-2 Hatagaya, Shibuya-ku, Tokyo

(74) Agent Susumu ITO, Attorney

(54) [Title of Invention]
FLUORESCENCE OBSERVATION APPARATUS

(57) [Abstract]
[Purpose]
To achieve an efficient and accurate fluorescence diagnosis regardless of parts and condition of organism's tissue with a simple constitution.

[Constitution]
In normal observation, a normal image acquired by an endoscope 1 by white light from a lamp 3a of a normal illumination light source 3 is detected by a normal video camera 6 via a second adapter 5. In fluorescence observation, a reflected light monitor 27 monitors the quantity of the reflected light of excitation light from a laser unit for fluorescence 4 so that the excitation light λ_0 at the wavelength of the least quantity of light is detected and a control signal is transmitted to the laser unit for fluorescence 4 and the excitation light λ_0 of the wavelength detected with the laser unit for fluorescence 4 is oscillated to take a fluorescence image obtained with the endoscope 1 at the excitation light λ_0 with a

fluorescence image photographing camera 7 through the second adapter 5. Then, a lesion and a normal tissue are determined by calculating the ratio of fluorescence at the wavelength λ_1 and λ_2 acquired by a fluorescence image processor 9.

[Claim]
[Claim 1]
A fluorescence diagnosing apparatus, which irradiates excitation light to an organism's tissue and diagnoses a lesion of the aforementioned organism's tissue by fluorescence generated from the aforementioned organism's tissue, which is provided with an excitation light supply means to provide the aforementioned excitation light; and a detecting means for detecting the reflected light of the aforementioned excitation light from the aforementioned organism's tissue. A fluorescence diagnosing apparatus which is characterized by the fact that the aforementioned excitation light supply means controls the wavelength of the aforementioned excitation light to be supplied based on the output from the aforementioned detecting means.

[Detail Description of the Invention]
[0001]
[Technical Field of the Invention]
This invention relates to a fluorescence diagnosing apparatus which irradiates excitation light to an area to be examined and diagnoses a diseased area by fluorescence emitted from the area to be examined.

[0002]
[Prior Art]
In recent years, techniques such as auto-fluorescence, which is generated directly from living tissue by irradiating the excitation light to an observation area of living tissue, and drug-induced fluorescence, which is generated by injecting a fluorescent medicine into the organism beforehand, produce two-dimensional images which are used to diagnose the degeneration of tissues of the organism or a state of the disease (for example, the type of the disease or the extent of infiltration), such as a cancer.

[0003]
If excitation light irradiates living tissue, the wavelength of the fluorescence generated will be longer than that of the excitation light.
Fluorescence substances in the organism are, for example, collagen, NADH (nicotinamide adenine dinucleotide), FMN (flavin mononucleotide), pyridine nucleotide, etc. Recently, the interrelation between these substances in the organism emitting fluorescence light and diseases is becoming clear, and the diagnosis of cancer, etc. is possible by this fluorescence.
Alternatively, a fluorescence substance such as HpD (hematoporphyrin), Photofrin, ALA((delta)-amino levulinic acid), etc., may be injected into an organism. These substances have a tendency to accumulate in cancerous tissue, and a diseased area can be diagnosed by observing the fluorescence after injecting any of these substances into an organism.

[0004]
Fluorescence emitted is extremely weak so that extremely high sensitivity photography is required. It is widely known that an image intensifier is used for high sensitivity photography.

[0005]
[Problem to be Solved by the Invention]
However, a fluorescence diagnosing apparatus for performing fluorescence observation with a conventional endoscope observes by distinguishing a normal area and a diseased area by the fluorescence intensity and distribution from the organism's tissue by excitation light. However, depending on mucus or blood flow of organism's tissue (tissue surface), or different part of an organ, the fluorescence intensity and wavelength distribution obtained by excitation light which is a single wavelength differ so that accurate and efficient fluorescence diagnosis may not be performed by an excitation light with a fixed single wavelength.

[0006]
This invention is formed in the consideration mentioned above. The purpose of this invention is to provide a fluorescence diagnosing apparatus with a simple constitution capable of performing fluorescence diagnosis efficiently and accurately regardless of parts or condition of organism's tissue.

[0007]
[Means and Operation to Solve the Problem]
A fluorescence diagnosing apparatus of this invention, which irradiates the excitation light to an organism's tissue and diagnoses a diseased area of the aforementioned organism's tissue according to the fluorescence emitted from the aforementioned organism's tissue, which is provided with an excitation light supply means to provide the aforementioned excitation light; and a detecting means for detecting the reflected light of the aforementioned excitation light from the aforementioned organism's tissue. A fluorescence diagnosing apparatus which is characterized by the fact that the aforementioned excitation light supply means controls the wavelength of the aforementioned

excitation light to be supplied based on the output from the aforementioned detecting means. A fluorescence diagnosis can be performed efficiently and accurately regardless of parts or condition of organism's tissue.

[0008]
[Embodiment]
Hereafter, embodiments of this invention are described referring to drawings.

[0009]
Fig. 1 and Fig. 2 relate to a first embodiment of this invention. Fig. 1 is a block diagram showing the structure of a fluorescence observation endoscope apparatus. Fig. 2 is a characteristic diagram showing the fluorescence characteristics of tissue in a body cavity when excitation light λ_0 is irradiated from the fluorescence observation endoscope apparatus of Fig. 1.

[0010]
As the first embodiment of a fluorescence diagnosing apparatus, a fluorescence observation endoscope apparatus shown in Fig. 1 comprises:
an endoscope 1 which is inserted into a body cavity and detects a normal image and a fluorescence image of an area to be observed, which is a diseased area, etc.;
a normal illumination light source 3 for supplying white light for normal observation to the endoscope 1 via a first adapter 2;
a laser unit for fluorescence 4 for supplying variable wavelength laser beam for excitation (for example, an alexandrite laser, a dye laser, a free electron laser, etc);
a normal video camera 6 for capturing a normal image captured by the endoscope 1 by the white light from a lamp 3 of the normal illumination light source 3 via a second adapter 5;
a fluorescence image detecting camera 7 for recording a fluorescence image captured by the endoscope 1 by the excitation light λ_0 from the fluorescence laser unit 4 via the second adapter 5;
a CCU (camera control unit) 8 for processing a normal image signal recorded by the normal video camera 6 and generating a normal image;
a fluorescence image processor 9 for processing a fluorescence image signal recorded by the fluorescence image detecting camera 7 and generating a fluorescence image;
a video switching controller 10 which detects the fluorescence quantity in longer wavelengths than that of the excitation light of the fluorescence image signal processed by the fluorescence image processor 9 and identifies a diseased area;
a video switcher 11 which inputs a normal image and a fluorescence image and outputs the normal image or the fluorescence image in correspondence with an identification signal from the video switching controller 11;
a monitor 12 which displays output images from the video switcher 11; and
a reflected-light monitor 27 for monitoring the reflected-light quantity from the fluorescence image obtained by the CCU 8 after receiving the reflected light of the laser light radiated from the fluorescence laser unit 4 via the endoscope 1

[0011]
The first adapter 2 is structured to introduce an excitation light λ_0 from the fluorescence laser unit 4 and a white light from the lamp 3a of the normal light source 3 into a light guide 15, which is inserted into the endoscope 1, by switching the position of a movable mirror 14 via a driver 13 (a solid line indicates the position of the movable mirror 14 for white light and a broken line for excitation light λ_0 in Fig.1). The light guide 15 is structured to transmit light from the first adapter 2 to the distal tip of the endoscope 1 and to irradiate it outwardly. The return light from the area to be examined by the light irradiated is transmitted as an observation image (a normal image or fluorescence image) to an eyepiece part 17 of the endoscope 1 through an image guide 16 which is inserted into the endoscope 1.

[0012]
The second adapter 5 is detachably connected to the eyepiece part 17. The second adapter 5 switches between a normal image and a fluorescence image by operating a movable mirror 19 via a driver 18 (a solid line indicates the position of the movable mirror 19 for a normal image and a broken line indicates the position for a fluorescence image.) A normal image is introduced into the normal video camera 6 and a fluorescence image is introduced into the fluorescence image detecting camera 7. In the normal video camera 6, a normal image is taken by a built-in CCD 20 and a normal image signal is transmitted to the CCU 8. The normal image is displayed on the monitor 12 via the video switcher 11 in accordance with the identification signal from the video switching controller 10.

[0013]
In the fluorescence image detecting camera 7, a fluorescence image is amplified by an image intensifier (I.I) 22 via a rotatable filter 21, which has two band-pass filters with transmission characteristics that transmit light at wavelengths λ_1 and λ_2. Then, the image is projected onto a CCD 23

and a fluorescence image signal is transmitted to the fluorescence image processor 9. The fluorescence image is displayed on the monitor 12 via the video switcher 11 in accordance with the identification signal from the video switching controller 10. In addition, the rotatable filter 21 is disc shaped and provided with two band pass filters having the transmission characteristics that transmit light at wavelengths λ_1 and λ_2 and it is rotated by the drive of a motor 24.

[0014]
The operation of a fluorescence observation endoscope apparatus comprised as above will be explained.

[0015]
At the time of fluorescence diagnosis, first, the excitation light from the fluorescence laser unit 4 through the endoscope irradiates an organism's tissue while changing a wavelength continuously or stepwise. The reflected light of the excitation light of the organism's tissue is projected onto a CCD 20 via an image guide 16 and then light quantity of the reflected light of excitation light is monitored by a reflected-light monitor 27.

[0016]
Fig. 2 illustrates the fluorescence characteristics when excitation light λ_0 is irradiated. For example, fluorescence light from tissue obtainable due to irradiation with excitation light λ_0 at 442nm is intense in a normal area and is weak in a diseased area in a short wavelength region. That is, the ratio of the intensities of fluorescence light having the wavelengths λ_1 and λ_2 becomes different between a healthy area and a diseased area. Therefore, it is possible to distinguish whether the area is normal or diseased by calculating the ratio of λ_1 and λ_2. In order to perform more accurate distinction of a normal area and a diseased area, excitation light with a wavelength which has a bigger difference between the ratio of λ_1 and λ_2 can be chosen. However, an optimum wavelength may be changed when mucus or blood is on the tissue surface.

[0017]
Therefore, a reflected-light monitor 27 detects the excitation light with a wavelength having a minimum reflected-light quantity (which is the wavelength having the optimum absorbency of the excitation light) by monitoring the light quantity of the reflected-light of excitation light and sends the control signal to a fluorescence laser unit 4. In this case, by storing the reflection characteristics of blood and mucus beforehand and using this data for compensation, the accuracy can be further improved.

[0018]
The fluorescence laser unit 4 oscillates the excitation light with the wavelength generating most fluorescence from the organism (which is the wavelength with high absorbency for excitation light and with minimum quantity of the reflected light of excitation light) in accordance with the control signal from the reflected light monitor 27.

[0019]
If the excitation light detected by the reflected light monitor 27 is considered to be the excitation light λ_0, the excitation light λ_0 is supplied by the fluorescence laser unit 4 and the organism's tissue shows a fluorescence characteristics similar to Fig. 2. Thus, a fluorescence image is separated into images of λ_1 and λ_2 and amplified by I.I. 22 and projected onto CCD 23.

[0020]
In addition, in Fig. 1, the movable mirrors 14 and 19 are synchronized with a timing controller 25 and are operated by the drivers 13 and 18. The timing rotation of the motor 24 for rotating the rotatable filter 21 is also controlled by the timing controller 25.

[0021]
The video switcher 11 outputs a normal image from the CCU 8 and a fluorescence image from the fluorescence image processor 9 to the monitor 12 in correspondence with an identification signal from the video switch controller 10. A normal image or a fluorescence image can also be switched by a foot switch 26.

[0022]
Moreover, the selection of excitation wavelength and the identification of a disease area and a normal area may be performed by applying a fuzzy control, AI, neutral net, etc. In addition, in order to increase an accuracy of the identification of a diseased area and normal area, a gamma-ray detector may be employed.

[0023]
According to the fluorescence observation endoscope apparatus of the first embodiment, the accurate fluorescence diagnosis can be performed by selectively using the excitation light having the most suitable wavelength to emit fluorescence for an area to be observed.

[0024]

Next a second embodiment will be explained. Fig. 3 and Fig. 4 relate to the second embodiment of this invention. Fig. 3 is a block diagram showing the structure of a fluorescence observation endoscope apparatus. Fig. 4 is a block diagram showing the structure of a rotatable filter in Fig. 3. Since the components of the second embodiment are similar to the first embodiment, the same symbols will be utilized for the same parts and the explanation of those will be omitted. Differences between the first embodiment will be described.

[0025]
As shown in Fig. 3, in the second embodiment, an apparatus comprises:
a rotatable filter 21a which is provided instead of the rotatable filter 21 in the first embodiment; and
a moving means 28 which operates a motor 24 to rotate to the direction of the diameter of filter insertion of the rotatable filter 21a in accordance with the movement control signal from a reflected-light monitor 27.

[0026]
The rotatable filter 21a provided with band pass filters 31, 32, 33, 34, which have characteristics to pass through four different wavelength bands $\lambda_1, \lambda_2, \lambda_3, \lambda_4$, on a disc which is divided in two semicircles and further divided into four as shown in Fig. 4.

[0027]
Then, in response to the moving control signal from the reflected light monitor 27, the rotatable filter 21a is rotated by moving the moving the motor 24 toward the insertion diameter of the rotatable filter by the moving means 28.
For example, as explained in the first embodiment (refer to Fig. 2), when the wavelength of the excitation laser of the fluorescence laser unit 4 is λ_0 by the control signal from the reflected light monitor 27, a fluorescence image is acquired through the band-pass filters 31 and 32 (transmitting wavelengths λ_1 and λ_2), which is provided on the inner circumference. (The motor 24 is moved to the left of the drawing).
When the control signal from the reflected light monitor 27 is different from λ_0 and the wavelength is λ_0', (the motor 24 is move to the right of the drawing), a fluorescence image is acquired through the band-pass filters 33 and 34 (transmitting wavelengths λ_3 and λ_4), which is provided on the outer circumference and which is suitable for fluorescence sensitivity by the excitation light λ_0' (which makes the most difference on the ratio of the fluorescence intensity of a diseased area and a normal area). Other structures and operations are the same as that of the first embodiment.

[0028]
The apparatus comprised as above, in addition to the effect of the first embodiment, a fluorescence image, which is generated by the excitation light from the fluorescence laser unit 4 controlled by the control signal from the reflected light monitor 27, is observed by moving the motor 24 toward the rotatable filter insertion so as to rotate the rotatable filter 21a by the moving means 28 in accordance with the moving control signal from the reflected-light monitor 27. Thus, a fluorescence wavelength can be selected according to the excitation light wavelength and more accurate fluorescence diagnosis can be performed.

[0029]
In addition, in the above-mentioned second embodiment, a fluorescence wavelength is selected according to the specific wavelength excitation light selected by the reflected light monitor 27. However, it is not limited to this. For example, a fluorescence diagnosis may be performed after the observation for the excitation light with the specific wavelength is performed with both the band-pass filters 31 and 32 (transmitting wavelengths λ_1 and λ_2) and with the band-pass filters 33 and 34 (transmitting wavelengths λ_3 and λ_4). The observations by the band pass filters 31 and 32 (transmitting wavelengths λ_1 and λ_2) and the band pass filters 33 and 34 (transmitting wavelengths λ_3 and λ_4) may also be performed for the excitation light with several wavelengths. By doing this, more data about fluorescence images from an area of fluorescence observation can be obtained so that more accurate fluorescence diagnosis can be performed.

[0030]
When an image intensifier (I.I.) 22 is connected with an eyepiece part 17 of the endoscope 1 for fluorescence observation, the operability is poor since the weight of the I.I. 22 is added on the operation unit of the endoscope 1 and the I. I. 22 is big. In addition, the I.I. 22 is built of precise electrical parts so that sterilization can not be secured.

[0031]
Therefore, by constituting an image guide with polymer optical fibers for guiding excitation light and adding an optical fibers amplifier system, auto fluorescence can be observed without image intensifiers. Thus, the embodiment of a fluorescence observation endoscope apparatus that is capable of improving the operability and sterilization ability and

performing more accurate and safe fluorescence diagnosis will be explained next.

[0032]
An embodiment of a fluorescence observation endoscope apparatus capable of performing fluorescence diagnosis without image intensifiers is provided with:
a light source 41 which emits white light or laser light by switch;
an endoscope 42 by which the aforementioned white light or laser light is irradiated into a body cavity and performs observation of a normal image or fluorescence image of tissue;
an image processor 43 which superimposes the aforementioned normal image or fluorescence image on the same screen and performs the process of pseudo-color image obtained by the fluorescence image so as to make a diseased area recognizable;
an excitation light source for amplification 46 which performs optical pumping to amplify fluorescence and which is optically combined with an IG (image guide) 45 passed through in the aforementioned endoscope 42;
a timing controller 50 which controls the light source 41 for switching between the aforementioned fluorescence image and the normal image, the image processor 43, the excitation light source for amplification 46, and a motor which operations the rotation drive of the rotatable filter 47 in an operation unit 44 of the endoscope 42; and
a monitor 51 for displaying the image processed by the aforementioned image processor 43.

[0033]
The aforementioned light source 41 is provided with a Xe lamp 52 for generating white light and a He-Cd laser 53 for exciting fluorescence. A white light from the Xe lamp 52 via a lens 56 or an excitation light from the He-Cd laser 53 via a mirror 54 and a lens 55 is selected by an optical mirror 57 and introduced into a LG (light guide) 59, which passes through an light guide cable 57 and an insertion part 58 of the endoscope 42.

[0034]
A diffusion lens 60 for uniformly spread and irradiate the white light or excitation light by the aforementioned light source 41 into a body cavity, and a objective lens 61 for detecting a normal image or a fluorescence image are provided in the distal end of the aforementioned endoscope 42.

[0035]
In the operation unit 44, a CCD 62 is provided to capture an image transmitted through the IG 45, which is inserted in an insertion part 58 and transmits or amplifies a fluorescence image or normal image. Then, a normal image or a fluorescence image via a lens 63 is projected onto the detecting surface of the CCD 62. In addition, dichroic mirrors 64 and 65, which reflect excitation light, are arranged on both ends of the IG image guide 45 for amplifying a fluorescence image. Lenses 67 and 68 and a half mirror (beam splitter) 69 are arranged to project the amplifying excitation light from the excitation light source for amplification 46 into the IG 45 via an optical fiber 66.

[0036]
In this case, the IG 45 consists of polymer optical fibers which doped in "Rhodamine 6G" and "Perylene Red".

[0037]
The aforementioned rotatable filter 47 is located between the lens 63 and the CCD 62. The rotatable filter 47 is rotated by the motor 48 controlled by the timing controller 50. For example, when a fluorescence image is transmitted, it passes through a band pass filter 71 (transmitting wavelength λ_1) and a band pass filter 72 (transmitting wavelength λ_2). When a normal image is transmitted, it passes through an area 73 which has no filter mounted. In other words, the motor 48 is controlled by the aforementioned timing controller 50, and the filters on the rotatable filter 47 are sequentially switched.

[0038]
The aforementioned excitation light source for amplification 46 comprises a YAG laser 74 and a SHG (second harmonic generation/frequency doubler) 75 which outputs second higher harmonic of light by the aforementioned YAG laser 74.

[0039]
Thus, in this embodiment comprised above, the white light or excitation light from the light source 41 is first introduced into a body cavity (such as stomach, large intestine, bronchus, bladder) or the abdominal cavity, or a chest cavity.

[0040]
When a body cavity is irradiated with white light, an image of the body cavity is transmitted by the objective lens 61 and the IG 45 and the region 73 with no filter and is recorded by the CCD 62. Then, after the image is stored temporarily into the imaging memory of the image processor 43 (not illustrated), it is displayed on the monitor 51.

[0041]

On the other hand, when excitation light such as a He-Cd laser 53 with 442nm wavelength irradiates an organism's tissue, green fluorescence, which is associated with flavin, is emitted from a normal tissue. However, in an abnormal tissue such as cancerous tissue, fluorescence changes to a dark-yellowish fluorescence that has low fluorescence intensity in the green region.

[0042]
The IG 45 receives this fluorescence like the example of white light. However, the intensity of fluorescence is extremely weak so that the CCD 62 can not record this fluorescence intact. Therefore, the light having a 1064nm wavelength is generated by the YAG laser 74 in the excitation light source for amplification 46 and then converted into the light with a 532nm wavelength by the SHG (frequency doubler) 75. After the light is transmitted by the optical fiber 66 and is uniformly spread by the lenses 67 and 68, it is entered into the IG 45 via the half mirror (beam splitter) 69.

[0043]
As above mentioned, the IG 45 consists of polymer optical fibers which are doped in the "Phodamine 6G" and "Perylene Red". If the 532nm-excitation light is entered into the IG 45, the 571nm-fluorescence which responses to the "Rhodamine 6G" and the 621nm-fluorescence which responses to the "Perylene Red" are amplified. At this time, the gain is 600 –2000 times.

[0044]
The band-pass filters 71 and 72 of the rotatable filter 47 extracts the wavelength λ_1 (for example, 571nm) and λ_2 (for example, 621nm) from the fluorescence amplified and reduce noise, and each fluorescence is captured by the CCD 62.
The normal tissue and abnormal tissue in these images is distinguished according to the image memory and calculation device (both not illustrated) in the image processor 43.

[0045]
The aforementioned normal image and fluorescence image are sequentially switched by the timing controller 50 and displayed separately or simultaneously (superimposed) on the monitor 51.

[0046]
According to this embodiment, the organism's tissue is irradiated with the 442nm light from the He-Cd laser 53. Among fluorescence from abnormal tissue, a 571nm fluorescence that responds to the Phodamine 6G and 621 fluorescence that responds to the Pherylene Red are amplified to 600 -2000 times by the IG 45 which consists of polymer optical fibers. The rotatable filter 47 extracts fluorescence in the wavelength λ_1 (for example, 571nm) and λ_2 (for example, 621nm) and reduces noise, and each fluorescence is captured by the CCD 62. Thus, auto fluorescence can be observed without image intensifiers and the operability and sterilization ability is improved so that accurate and safe fluorescence diagnosis can be performed.

[0047]
In addition, a YAG laser is used as a laser beam for the excitation light source for amplification 46. However, it is not limited to this device and a semiconductor laser, an argon laser, an excimer laser may be used.

[0048]
Also, in order to diagnose a diseased area, the organism's tissue is irradiated with 442nm a He-Cd laser 53 and auto fluorescence from the tissue amplified by the IG 45, which consists of polymer optical fibers,. is observed. However, it is not limited to this and fluorescence substances such as HpD (hematoporphyrin), Photofrin, ALA ((delta)-amino levulinic acid), NP e6, BPD, SnET2, etc., may be injected into an organism. These substances have a tendency to accumulate in cancerous tissue, and a diseased area can be diagnosed by observing the fluorescence which is amplified by the IG 45 consisting of polymer optical fibers after injecting any of these substances into an organism.

[0049]
Fig. 6 is a modification example of the embodiment of Fig. 5. In the embodiment of Fig. 5, the apparatus was structured with the endoscope used for fluorescence observation in which the polymer optical fiber bundle was employed as the IG 55. However, this type of endoscope is unique and expensive. Therefore, a fluorescence observation endoscope apparatus of this modification is structured to be able to observe fluorescence using a normal endoscope without an image intensifier. This modification is similar to the embodiment in Fig. 5. The same symbols will be utilized for the same parts and the explanation of those will be omitted. Different parts will be described.

[0050]
In other words, a fluorescence observation endoscope apparatus shown in Fig. 6 which is a modification of the apparatus of Fig. 5 comprises:
an endoscope 81 in which an image guide 45a is inserted through to transmit normal images; and

a polymer optical fiber bundle 82 is provided in a coupling device 85 connecting an eyepiece part 83 and a fluorescence image detecting apparatus 84. The fluorescence image detecting apparatus 84 is composed of a YAG laser 74, a SHG 75, a rotatable filter 47, etc. The light from the SHG 75 is introduced into a half mirror (beam splitter) 69 via a mirror 86. The polymer optical fiber bundle 82 consists of polymer optical fibers doped with "Phodamine 6G" and "Perylene Red". Other components and operation are the same as that of the embodiment of Fig. 5.

[0051]
According to the modification comprised above, in addition to the effect of the embodiment of Fig. 5, the coupling device 85 housing the polymer optical fiber bundle 82 is mounted between the eyepiece part 83 and the fluorescence image detecting apparatus 84 of the endoscope 81. Thus, the conventional endoscope can be used and a fluorescence observation endoscope apparatus capable of observing auto fluorescence without image intensifiers can be realized inexpensively.
In addition, a variable wavelength laser (of the embodiment of Fig. 1 and Fig. 4) may be placed for a He-Cd laser (of the embodiments of Fig. 5 and Fig. 6) and the reflected light is monitored so that optimum wavelength is selected. Therefore, more accurate diagnosis is possible.

[0052]
In order to observe a fluorescence image by a fluorescence observation endoscope apparatus, an operator manually operates the bend of an endoscope while confirming a fluorescence image with eyes. Thus, when screening a diseased area by confirming a fluorescence with eyes, the operator may change the angle for screening carefully or a diseased area may be missed in a case where the difference of fluorescence is subtle and very little.

[0053]
Next, a fluorescence observation endoscope apparatus of this embodiment which is capable of improving the operability and detecting lesions accurately by stopping the angle of an endoscope in a place where lesions exist and by detecting a subtle and minute difference of fluorescence will be explained.

[0054]
A fluorescence observation endoscope apparatus of this embodiment shown in Fig. 7, which detects the subtle and very little fluorescence and stops the angle of the endoscope at the certain point of a diseased part, comprises:
a light source apparatus 91 which generates a white light for normal observation; a laser source 92 which generates an excitation light for fluorescence observation; and
an endoscope 93 for observing a diseased area by irradiating the white light or excitation light from the distal tip 93a.

[0055]
The distal end of a light guide cable 95 extended from the operating part 94 of the endoscope 93 is detachably connected to the first adapter 97 which introduces a white light and an excitation light by switching. The first adapter 97 to which the aforementioned light source apparatus 91 and laser light source 92 are connected. A light guide (not illustrated) is inserted through the light guide cable 95 and the insertion part 96 of the endoscope 93.

[0056]
The operating part 94 of the endoscope 93 is provided with an articulation mechanism 98 operated by an electric motor (not illustrated) so as to operate bending operation of a bending part 99 at the distal end of the insertion part 96. For example, the articulation mechanism 98 is composed of two articulations and electric motor (not illustrated), and the bending operation is controlled by an articulation control unit 100. The distal end part 93a of the endoscope 93 can be directed to the desired direction by moving the bending part 99 up and down/right and left by he articulations and electric motor directions (not illustrated).

[0057]
Then, a fluorescence image and a normal image of a diseased area 102 and the periphery of the body cavity 101 are detected by the endoscope 93, and further detected by an I.I. 103 and a CCD camera 104. The fluorescence image and the normal image are selected and respectively input into the I.I. 103 and the CCD camera 104 by the second adapter 205.

[0058]
The fluorescence image captured by the I.I. 103 is processed by the fluorescence diagnosis processor 106 so that a normal area and abnormal area is distinguished. A CCU 107 generates an output image based on the normal image detected by the CCD camera 104. The images obtained by aforementioned fluorescence diagnosis processor 106 and the CCU 107 are switched or combined on the same screen by a superimposition 108. The output images from the superimposition 108, for example, a normal image

109 as a main image and a fluorescence image 110 as a sub image, are displayed on a monitor 111 simultaneously.

[0059]
However, a compound image displayed on the monitor 111 is not restricted to this and a compound image can also be made of a fluorescence image as a main image and a normal image as a sub-image. The display location of a sub-image can be voluntarily set. The monitor 111 can display not only a compound image but also display a fluorescence image or a normal image individually or a processed image that is processed image of these images.

[0060]
In the embodiment of Fig. 7 comprised above, first, the distal end 93a of the endoscope 93 is placed in the body cavity 101 (such as, lungs, an esophagus, the stomach, intestines, the pancreatic bile duct, the bladder, the ureter, an abdominal cavity, a thoracic cavity, the uterus). The light from the light source 91 and the laser light source 92 are sequentially irradiated to the body cavity 101 through the endoscope 93 by the adapter 97. At this time, the adapter 105 switches a normal image and a fluorescence image respectively and these images are captured by either the I.I. 103 or the CCD camera 104.

[0061]
At this time, the intensity and wavelength characteristic of the fluorescence image change between the diseased area 102 and a normal area. Thus, the diseased area 102 can be determined by processing the fluorescence intensity and wavelength characteristic in the fluorescence diagnosis processor 106.

[0062]
On the other hand, in the endoscope 93, the articulation mechanism 98 is operated by an articulation control unit 100 and the bending part 99 is manipulated so as to examine the body cavity 101. If the fluorescence diagnosis processor 106 discovers the diseased part 102, the articulation mechanism 98 is controlled to make the diseased area in center of sight of the endoscope 93. When it reaches the center, the bending operation is stopped and the operator is notified of the presence of the diseased area 102 by means such as monitor display or sound. Thus, a subtle and minute change in fluorescence can be detected and the angle [of the bending part 99] can be stopped at the location where the diseased area is present. The operability can be improved as well as a diseased area can be detected accurately.

[0064]
In addition, the CCD of a normal TV (video) camera in each embodiment described above is designed to take a normal image based on a white light. However, this CCD can be made to capture color images with the application of a color mosaic filter on the incident surface of the CCD. Also, a normal TV (video) camera may be made to take color images by providing a color filter which isolate white light into R, G, and B. Or a normal TV (video) camera is structured to detect color images in synchronization with the timing of light supply of the illumination light of R, G, and B from the normal illumination light source which is supplied sequentially.

[0065]
As described above, a laser beam for generating monochromatic light is used for an excitation light. However, a laser light source is expensive so that an excitation-light filter 120 as shown in Fig. 8 may be employed to select an excitation light from the white light of a Xe lamp efficiently.

[0066]
The excitation-light filter 120 is comprised of interference filters122 and 123, which transmit only excitation light λ_0 on which the interference coating is deposited, and a color filter 124, which absorbs the light except excitation light λ_1 and located between the interference filters 122 and 123.

[0067]
Excitation light λ_0 of the white light from the Xe lamp 121 is transmitted by the interference filter 122 and the light other than λ_0 is reflected. However, the filter also transmits a small amount of the light other than λ_0 at this time. The light other than λ_0 is blocked partially by the color filter 124 and the interference filters 123. The light other than λ_0 can be completely or almost absorbed by repeating the reflection between the interference filters 122 and 123. Thus, the light other than λ_0 can be stopped efficiently.

[0068]
As the result of using the excitation light filter 120, the light except λ_0, which is an excitation light with less leaked light, can be obtained. Thus, excellent fluorescence observation can be performed efficiently without using a laser apparatus for an excitation light source.

[0069]
[Additional Remarks]

1) In the fluorescence diagnosing apparatus mentioned in Claim 1, the aforementioned detection means detects the light quantity of the aforementioned reflected light, and the aforementioned supply means for excitation light controls a wavelength to have the minimum quantity of the aforementioned reflected light detected by the aforementioned detection means.

[0070]
2) The fluorescence diagnosing apparatus mentioned in Claim 1 is provided with a sampling means which samples intensities of several wavelengths of the aforementioned fluorescence.

[0071]
By comprising the apparatus in this manner, accurate fluorescence diagnosis can be performed because more data samples of fluorescence intensity and wavelength distribution can be obtained from the organism's tissue.

[0072]
3) A fluorescence diagnosing apparatus, which irradiates an organism's tissue with excitation light and diagnoses lesions according to fluorescence emitted from the aforementioned organism's tissue, which is characterized by having a sampling means for extracting intensities of several wavelengths of the aforementioned fluorescence.

[0073]
By comprising an apparatus in this manner, many samples of fluorescence intensity and wavelength distribution data from the organism's tissue can be obtained by a rotatable filter 21a that is a sampling means. Therefore, accurate fluorescence diagnosis can be performed.

[0074]
4) In the image transmission apparatus which transmits an image of internal part of an object as an optical signal by the optical fiber bundle, the aforementioned optical fiber bundle is provided with an amplification means which amplifies the aforementioned optical signal by the excitation light with a predetermined wavelength inside of the optical fiber bundle. The image transmission apparatus which is characterized by having an excitation light supply means for supplying the aforementioned excitation light and an excitation light incident means which enters the aforementioned excitation light supplied from the aforementioned excitation light supply means into the aforementioned optical fiber bundle.

[0075]
In the image transmission apparatus comprised in this manner, the excitation light is introduced by the image guide 45 which is the optical fiber bundle which consists of polymer optical fibers with amplification means. By adding the function to amplify optical signal, weak optical signals can be amplified without using an image intensifier.

[0076]
5) In the image transmission apparatus of Additional Remark 4, the aforementioned optical signal is fluorescence emitted from the inside of the object.

[0077]
6) In the image transmission apparatus of Additional Remark 5, the aforementioned fluorescence light is fluorescence substance accumulated in the organism's tissue or auto fluorescence.

[0078]
By observing weak fluorescence from the fluorescence substance or auto fluorescence with this image transmission apparatus, operability and sterilization performance on fluorescence observation can be improved and accurate and safe fluorescence diagnosis can be performed on an organism's tissue.

[0079]
7) In the image transmission apparatus of Additional Remark 6, the aforementioned fluorescence substance is at least one of HpD, Photofrin, ALA, Np e6, BPD, SnET2.

[0080]
8) In the image transmission apparatus mentioned in one of Additional Remarks 4, 5, and 6, the aforementioned optical fiber bundle is formed by at least one of the adjunction of Rhodamine 6G, Rhodamine B, Perylene Red.

[0081]
9) In the image transmission apparatus mentioned in one of Additional Remarks 4, 5, 6, and 7, the aforementioned excitation light source is one of a YAG laser, semiconductor laser, argon laser, or excimer laser.

[0082]
10) An endoscope apparatus which is characterized by having:
an endoscope which has the insertion part, to be inserted into a body cavity, provided with a bending means to bend a bending part at its distal end;

a diseased area detection means for detecting lesions of the aforementioned body cavity's tissue according to the aforementioned fluorescence captured by the aforementioned endoscope; and
a bending control means for controlling the aforementioned bending means based on the output of the aforementioned detection means.

[0083]
In the endoscope apparatus comprised in this manner, the fluorescence diagnosis processor 106 used as a diseased area detection means detects a diseased area based on the subtle and minute difference of fluorescence from the body cavity's tissue, and the articulation control unit 100 is controlled by the articulation mechanism 98 used as a bending means, and the bending part is bent to be positioned at a certain place in the sight of endoscope. Thus, operability can be improved and reliable detection of a diseased area is possible.

[0084]
11) In the endoscope apparatus of Additional Remark 10, the aforementioned fluorescence light is emitted from fluorescence substances accumulated into organism's tissue or auto fluorescence.

[0085]
12) In the endoscope apparatus of Additional Remarks 10 or 11, the aforementioned diseased area detection means detects the aforementioned diseased area by sampling the fluorescence intensity in more than two wavelength ranges.

[0086]
13) In the endoscope apparatus mentioned in either one of Additional Remarks 10,11, or 12, the bending control means controls the aforementioned bending means so that the aforementioned diseased area is set in the center of the sight of endoscope.

[0087]
14) In the endoscope apparatus mentioned in one of Additional Remarks 10, 11, 12, or 13, the aforementioned bending means is comprised of at least more than one articulation (angle wire) and an electrical motor.

[0088]
[Effect of Invention]
According to a fluorescence diagnosing apparatus of this invention as described above, a wavelength of excitation light supplied is controlled by the excitation light supply means controls the wavelength of excitation light based on the output of the detection means. As the result, efficient and accurate fluorescence diagnosis can be preformed regardless of the parts or condition of the organism's tissue with simple constitution.

[Brief Explanation of Drawings]
[Fig. 1]
Fig.1 is a block diagram of a fluorescence observation endoscope apparatus of the first embodiment.

[Fig. 2]
Fig. 2 is a diagram showing a fluorescence characteristic of tissue in a body cavity on which excitation light λ_0 is irradiated from the fluorescence observation endoscope apparatus in Fig. 1.

[Fig. 3]
Fig. 3 is a block diagram showing a fluorescence observation endoscope apparatus of the second embodiment.

[Fig. 4]
Fig. 4 is a block diagram showing a rotatable filter in Fig. 3.

[Fig. 5]
Fig. 5 is a block diagram showing an example of fluorescence observation endoscope apparatus capable of performing fluorescence diagnosis without an image intensifier.

[Fig. 6]
Fig. 6 is a block diagram showing the modification of the fluorescence observation endoscope apparatus in Fig. 5.

[Fig. 7]
Fig. 7 is a block diagram showing the example of a fluorescence observation endoscope apparatus which detects subtle and minute difference of fluorescence and stops the articulation at where a diseased area exists.

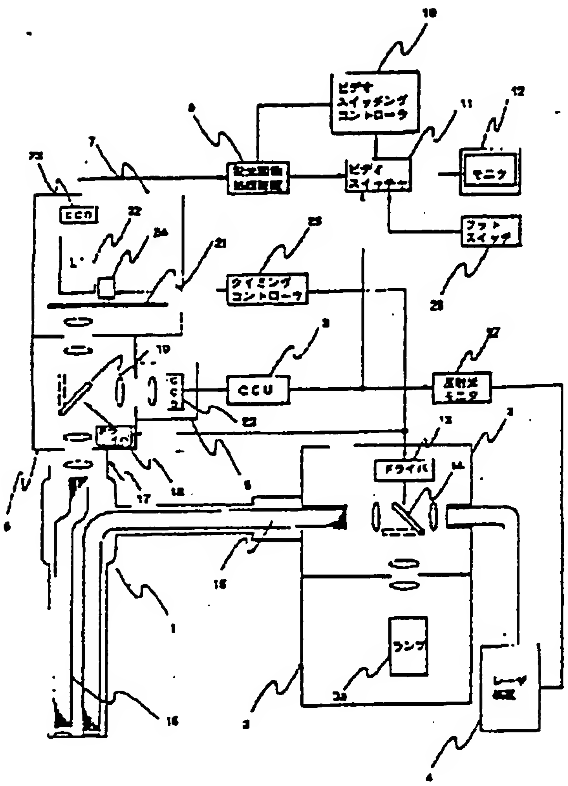
[Fig. 8]
Fig. 8 is a block diagram showing an excitation light filter which efficiently can select an excitation light from a white light from a Xe lamp.

[Explanation of Symbols]

6	normal TV (video) camera
7	fluorescence image detecting camera
8	CCU
9	fluorescence image processor
10	video switching controller
11	video switcher
12	monitor

13, 18	driver
14, 19	movable mirror
15	light guide
16	image guide
20, 23	CCD
21	rotatable filter
22	I.I. (image intensifier)
25	timing controller
27	reflected-light monitor
28	moving means

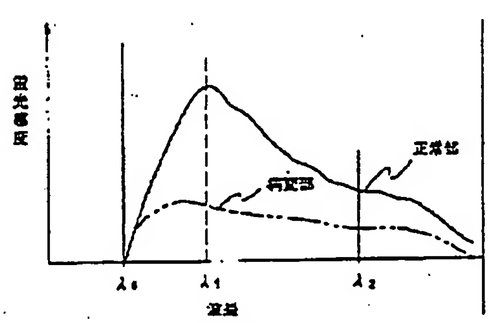
【図１】 [FIGURE 1]



[translation of Japanese text in Figure 1]

3a	lamp
26	foot switch

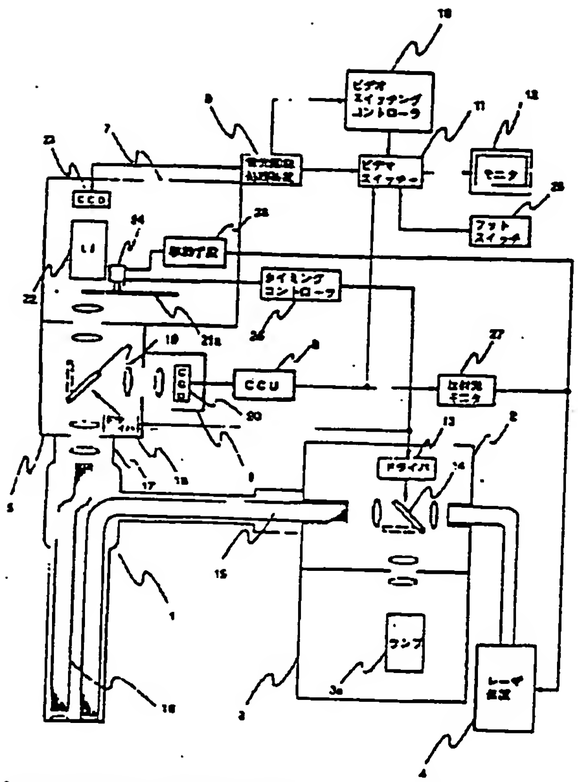
【図２】 [FIGURE 2]



[translation of Japanese text in Figure 2]

vertical axis:	fluorescent sensitivity
horizontal axis:	wavelength
upper line:	normal
lower line:	diseased part

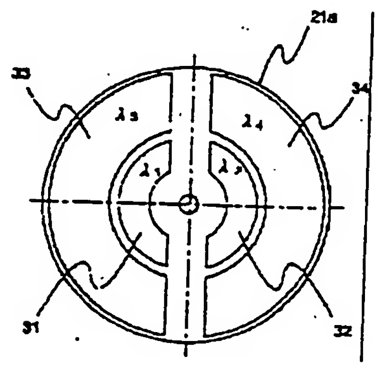
【図3】 [FIGURE 3]



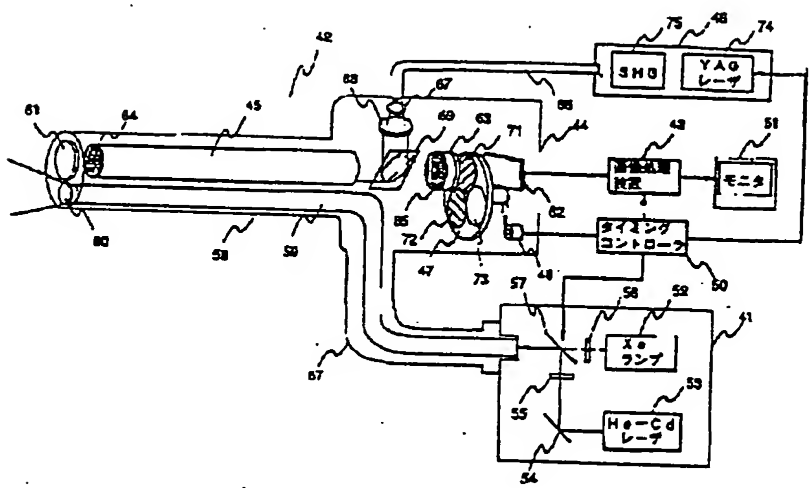
[translation of Japanese text in Figure 3]

3a	lamp
26	foot switch

【図4】 [FIGURE 4]

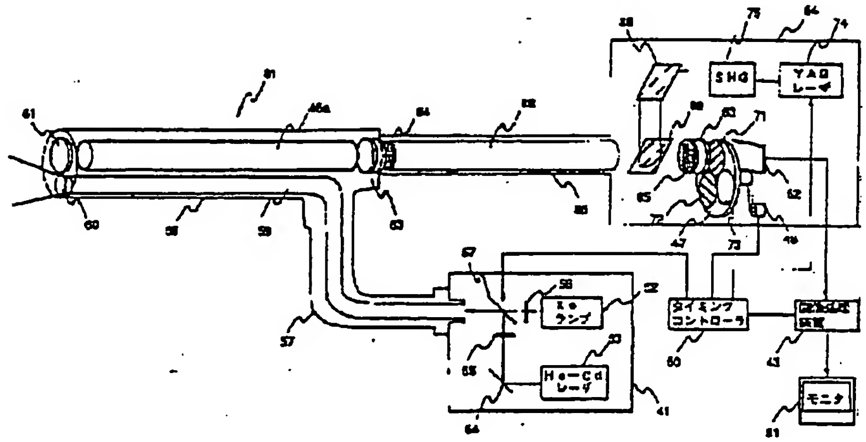


【図5】 [FIGURE 5]



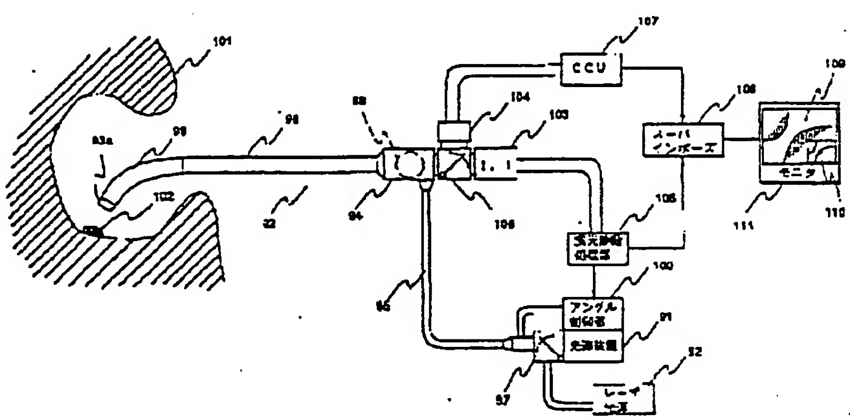
43	image processor
50	timing controller
51	monitor
52	Xe lamp
53	He-Cd laser
74	Yag laser

【図6】 [FIGURE 6]

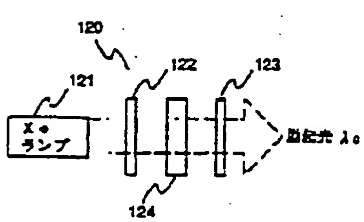


43	image processor
50	timing controller
51	monitor
52	Xe lamp
53	He-Cd laser
74	Yag laser

【図7】 [FIGURE 7]



【図8】 [FIGURE 8]



[translation of Japanese text in Figure 8]

121 Xe lamp

output excitation light $lambda_0$

DERWENT

MACHINE-ASSISTED TRANSLATION (MAT):

(19)【発行国】 日本国特許庁（ＪＰ）	**(19)[ISSUING COUNTRY]** Japanese Patent Office (JP)
(12)【公報種別】 公開特許公報（Ａ）	Laid-open (kokai) patent application number (A)
(11)【公開番号】 特開平７－２５０８１２	**(11)[UNEXAMINED PATENT NUMBER]** Provisional Publication No. 7-250812
(43)【公開日】 平成７年（１９９５）１０月３日	**(43)[DATE OF FIRST PUBLICATION]** October 3rd, Heisei 7 (1995)
(54)【発明の名称】 蛍光診断装置	**(54)[TITLE]** Fluorescent-diagnosis apparatus
(51)【国際特許分類第６版】 A61B 1/04 370 1/00 300 D 10/00 E T	**(51)[IPC]** A61B 1/04 370 1/00 300 D 10/00 E T
【審査請求】 未請求	**[EXAMINATION REQUEST]** UNREQUESTED
【請求項の数】 １	**[NUMBER OF CLAIMS]** One
【出願形態】 ＯＬ	**[Application form]** OL
【全頁数】 １０	**[NUMBER OF PAGES]** Ten
(21)【出願番号】 特願平６－４４４６２	**(21)[APPLICATION NUMBER]** Unexamined Japanese patent 6-44462

(22)【出願日】 平成６年（１９９４）３月１５日	**(22)[DATE OF FILING]** March 15th, Heisei 6 (1994)
(71)【出願人】	**(71)[PATENTEE/ASSIGNEE]**
【識別番号】 ０００００００３７６	**[PATENTEE/ASSIGNEE CODE]** 000000376
【氏名又は名称】 オリンパス光学工業株式会社	Olympus Optical K.K.
【住所又は居所】 東京都渋谷区幡ヶ谷２丁目４３番２号	**[ADDRESS]**
(72)【発明者】	**(72)[INVENTOR]**
【氏名】　金子　守	Kaneko, Mamoru
【住所又は居所】 東京都渋谷区幡ヶ谷２丁目４３番２号　オリンパス光学工業株式会社内	**[ADDRESS]**
(72)【発明者】	**(72)[INVENTOR]**
【氏名】　竹端　榮	Takehata, Sakae
【住所又は居所】 東京都渋谷区幡ヶ谷２丁目４３番２号　オリンパス光学工業株	**[ADDRESS]**

式会社内

(72)【発明者】	**(72)[INVENTOR]**
【氏名】　吉原　雅也	Yoshiwara, Masaya
【住所又は居所】 東京都渋谷区幡ヶ谷２丁目４３番２号　オリンパス光学工業株式会社内	**[ADDRESS]**
(72)【発明者】	**(72)[INVENTOR]**
【氏名】　飯田　雅彦	Iida, Masahiko
【住所又は居所】 東京都渋谷区幡ヶ谷２丁目４３番２号　オリンパス光学工業株式会社内	**[ADDRESS]**
(72)【発明者】	**(72)[INVENTOR]**
【氏名】　植田　康弘	Ueda, Yasuhiro
【住所又は居所】 東京都渋谷区幡ヶ谷２丁目４３番２号　オリンパス光学工業株式会社内	**[ADDRESS]**
(72)【発明者】	**(72)[INVENTOR]**
【氏名】　小林　至峰	Kobayashi, Yukimine

【住所又は居所】 東京都渋谷区幡ヶ谷２丁目４３番２号　オリンパス光学工業株式会社内	[ADDRESS]
(72)【発明者】	(72)[INVENTOR]
【氏名】　中村　一成	Nakamura, Kazunari
【住所又は居所】 東京都渋谷区幡ヶ谷２丁目４３番２号　オリンパス光学工業株式会社内	[ADDRESS]
(72)【発明者】	(72)[INVENTOR]
【氏名】　大明　義直	Ooaki, Yoshinao
【住所又は居所】 東京都渋谷区幡ヶ谷２丁目４３番２号　オリンパス光学工業株式会社内	[ADDRESS]
(74)【代理人】	(74)[PATENT ATTORNEY]
【弁理士】	
【氏名又は名称】　伊藤　進	Ito, Susumu
(57)【要約】	(57)[SUMMARY]

【目的】
簡単な構成により、生体組織の部位、状態によらず、効率的かつ正確な蛍光診断を行う。

[OBJECT]
By simple composition, regardless of the site of an organism tissue, and its state, efficient and exact fluorescent diagnosis can be performed.

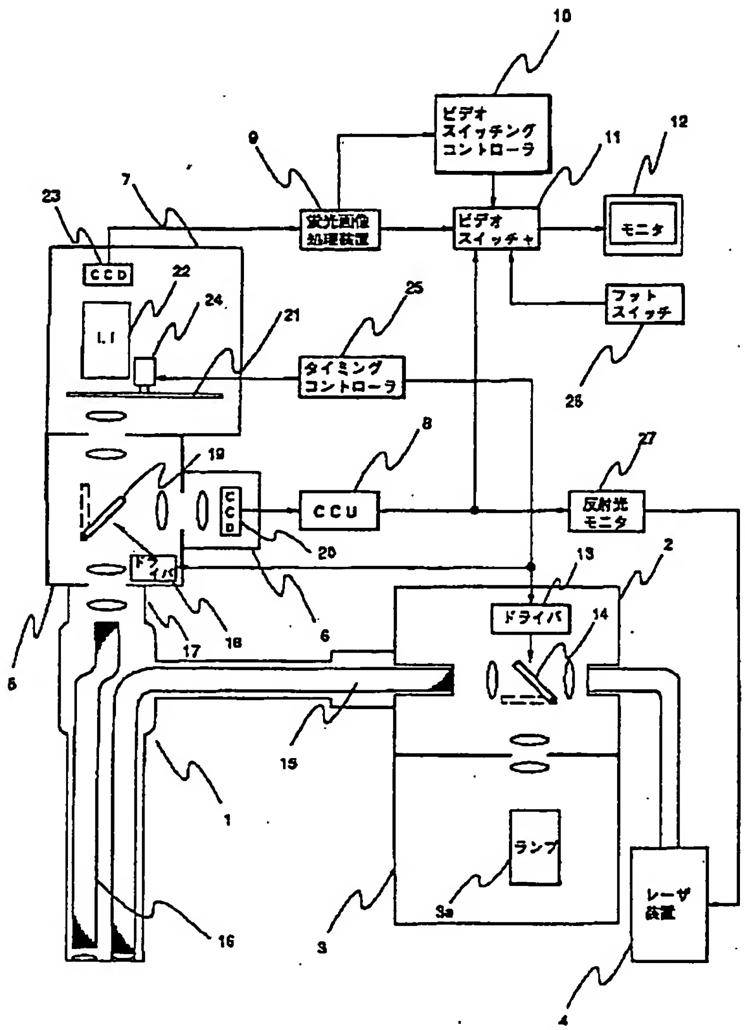
【構成】
通常観察時は、通常ＴＶカメラ６で通常照明光源３のランプ３ａからの白色光により内視鏡１で得られた通常観察像を第２アダプタ５を介して撮像する。蛍光観察時は、反射光モニタ２７が蛍光用レーザ装置４からの励起光の反射光の光量をモニタすることにより、光量が最も少ない波長の励起光λ０を検出し、蛍光用レーザ装置４に制御信号を送信し、蛍光用レーザ装置４で検出された波長の励起光λ０を発振させることで、蛍光像撮像カメラ７で励起光λ０により内視鏡１で得られた蛍光像を第２アダプタ５を介して撮像する。そして蛍光画像処理装置９で波長λ１，λ２の蛍光の比率を求めることで病変と正常を区別する。

[SUMMARY OF THE INVENTION]
At the time of a usual observation, the usual observation image obtained by the endoscope 1 according to white light from lamp 3a of the usual illumination light source 3 is recorded via the second adapter 5 with the usual TV camera 6.

At the time of fluorescent observation, when the reflected-light monitor 27 monitors the quantity of light of the reflected light of the excitation light from the laser apparatus for fluorescence 4, the excitation light (lambda) 0 of the wavelength with the lowest quantity of light is detected, and a control signal is transmitted to the laser apparatus for fluorescence 4.

By oscillating the excitation light (lambda) 0 of the wavelength detected with the laser apparatus for fluorescence 4, the fluorescent image obtained by excitation-light (lambda)0 by the endoscope 1 is recorded via the second adapter 5 with the fluorescent image image-pick-up camera 7.

And a disease and normal part are distinguished by measuring the fluorescent ratio of wavelength (lambda)1, (lambda)2 by the fluorescent image processing device 9.



[translation of Japanese text in Selection Diagram]
also refer to EXPLANATION OF DRAWINGS

3a lamp
26 foot switch

【特許請求の範囲】	**[CLAIMS]**
【請求項１】	**[CLAIM 1]**
生体組織に励起光を照射し、前記生体組織から発生する蛍光により前記生体組織の病変部を診	Excitation light is irradiated to an organism tissue. In the fluorescent-diagnosis apparatus which

断する蛍光診断装置において、
前記励起光を供給する励起光供給手段と、
前記励起光の前記生体組織からの反射光を検出する検出手段とを備え、
前記励起光供給手段は、
前記検出手段の出力に基づいて、供給する前記励起光の波長を制御することを特徴とする蛍光診断装置。

diagnoses the disease part of the above-mentioned organism tissue according to the fluorescence generated from the above-mentioned organism tissue, it has detection means to detect reflected light from the above-mentioned organism tissue of above-mentioned excitation light, excitation-light supply means to supply above-mentioned excitation light.
Above-mentioned excitation-light supply means controls the wavelength of the above-mentioned excitation light to supply, based on the output of above-mentioned detection means.
The fluorescent-diagnosis apparatus characterized by the above-mentioned.

【発明の詳細な説明】

[DETAILED DESCRIPTION OF INVENTION]

【０００１】

[0001]

【産業上の利用分野】
本発明は、被検査対象に励起光を照射し、その被検査対象から発する蛍光より、疾患部位を診断する蛍光診断装置に関する。

[INDUSTRIAL APPLICATION]
This invention irradiates excitation light for an examination object.
From the fluorescence emitted from the examination object, it is related with the fluorescent-diagnosis apparatus which diagnoses an illness site.

【０００２】

[0002]

【従来の技術】
近年、内視鏡等により生体からの自家蛍光や、生体へ薬物を注

[PRIOR ART]
In recent years, using an endoscope etc, from the self-fluorescence from the organism, or by

入し、その薬物の蛍光を２次元画像として検出し、その蛍光像から、生体組織の変性や癌等の疾患状態（例えば、疾患の種類や浸潤範囲）を診断する技術がある。

medicine being injected into the organism, the resulting fluorescence is used as a two-dimensional image.

From the fluorescent image, there is a technique whereby illness states (for example, the kind and permeation extent of the illness), such as the modification of an organism tissue and cancer, are diagnosed.

【０００３】

生体組織に光を照射するとその励起光より長い波長の蛍光が発生する。生体における蛍光物質として、例えばＮＡＤＨ（ニコチンアミドアデニンヌクレオチド），ＦＭＮ（フラビンモノヌクレオチド），ピリジンヌクレオチド等がある。最近では、このような、生体内因物質と、疾患との相互関係が明確になってきた。また、ＨｐＤ（ヘマトポルフィリン），Ｐｈｏｔｏｆｒｉｎ，ＡＬＡ（δ－ａｍｉｎｏ ｌｅｖｕｌｉｎｉｃ ａｃｉｄ）は、癌への集積性があり、これを生体内に注入し、前記物質の蛍光を観察することで疾患部位を診断できる。

[0003]

If a light is irradiated to an organism tissue, the fluorescence of a wavelength longer than the excitation light will occur.

It uses as the fluorescent material in the organism, for example, there are NADH (nicotinamide adenine nucleotide), FMN (flavin mononucleotide), pyridine nucleotide, etc.

Recently, the interactive relationship between illness and such in-the-living-body ?factor-substance? becomes clear.

Moreover, HpD (hematoporphyrin) and Photofrin, ALA((delta)-amino levulinic acid) have the accumulation property towards cancer.

This is injected in the living body, and an illness site can be diagnosed by observing the fluorescence of the above-mentioned matter.

【０００４】

このような蛍光は、極めて微弱であるので、その観察のためには、極めて高感度の撮影を必要とする。この高感度撮影を行うものとしてイメージ・インテンシファイヤが良く知られてい

[0004]

Since such a fluorescence is very slight, it needs photography of a high sensitivity extremely for the observation.

The image * intensifier is well known as that which performs this high-sensitivity photography.

る。

【０００５】

[0005]

【発明が解決しようとする課題】
しかしながら、従来の内視鏡による蛍光観察を行う蛍光診断装置は、励起光による生体組織からの蛍光の強度及び分布により正常部と病変部を識別して観察を行うものであるが、生体組織（表面）の粘液や血流状態あるいは部位臓器の違いにより、単一波長の励起光により得られる蛍光の強度及び波長分布が異なるために、固定した単一波長の励起光では、正確で効率のよい蛍光診断が行えない場合がある。

[PROBLEM ADDRESSED]
However, with the fluorescent-diagnosis apparatus which performs the fluorescent observation by the conventional endoscope, according to the fluorescent strength and the fluorescent distribution from the organism tissue by excitation light, the identification of a normal part and the disease part is achieved.

However, based on the pituita of an organism tissue (surface) and the difference of a blood-flow state or a site organ, since fluorescent strength and a wavelength distribution which are obtained by the excitation light of a single wavelength differ from each other, with the excitation light of the fixed single wavelength, exact and efficient fluorescent diagnosis may be unable to be performed.

【０００６】
本発明は、上記事情に鑑みてなされたものであり、簡単な構成により、生体組織の部位、状態によらず、効率的かつ正確な蛍光診断を行うことのできる蛍光診断装置を提供することを目的としている。

[0006]
This invention is made in view of the above-mentioned situation.

By simple composition, regardless of the site of an organism tissue, and its state, it aims at providing the fluorescent-diagnosis apparatus which can perform efficient and exact fluorescent diagnosis.

【０００７】

[0007]

【課題を解決するための手段及

[SOLUTION OF THE INVENTION and

び作用】
本発明の蛍光診断装置は、生体組織に励起光を照射し、前記生体組織から発生する蛍光により前記生体組織の病変部を診断する蛍光診断装置において、前記励起光を供給する励起光供給手段と、前記励起光の前記生体組織からの反射光を検出する検出手段とを備え、前記励起光供給手段が、前記検出手段の出力に基づいて、供給する前記励起光の波長を制御することで、簡単な構成により、生体組織の部位、状態によらず、効率的かつ正確な蛍光診断を行うことを可能とする。

EFFECT]
The fluorescent-diagnosis apparatus of this invention irradiates excitation light to an organism tissue.

In the fluorescent-diagnosis apparatus which diagnoses the disease part of the above-mentioned organism tissue according to the fluorescence generated from the above-mentioned organism tissue, it has excitation-light supply means to supply above-mentioned excitation light, and detection means to detect reflected light from the above-mentioned organism tissue of above-mentioned excitation light.

Above-mentioned excitation-light supply means enables it perform independent of the site of the organism tissue, and its state, and to perform efficient and exact fluorescent diagnosis by simple composition by controlling the wavelength of the above-mentioned excitation light to supply, based on the output of above-mentioned detection means.

【0008】

[0008]

【実施例】
以下、図面を参照しながら本発明の実施例について述べる。

[Embodiment]
Hereafter, the embodiment of this invention is described, referring to drawings.

【0009】
図1及び図2は本発明の第1実施例に係わり、図1は蛍光観察内視鏡装置の構成を示す構成図、図2は図1の蛍光観察内視鏡装置により励起光λ0を照

[0009]
Figs. 1 and 2 concern the 1st embodiment of this invention.

Diagram 1 is a block diagram showing the composition of the fluorescent observation endoscope apparatus. diagram 2 is a

射した時の体腔内組織の蛍光特性を示す特性図である。

characteristic view showing the fluorescent characteristic of the intra-corporeal tissue when irradiating excitation-light (lambda)0 with the fluorescent observation endoscope apparatus of diagram 1.

【００１０】

蛍光診断装置としての第１実施例の蛍光観察内視鏡装置は、図１に示すように、体腔内に挿入し疾患部位等の観察部位の通常観察像及び蛍光観察像を得る内視鏡１と、この内視鏡１に第１アダプタ２を介して通常観察用の白色光を供給する通常照明光源３及び励起用の波長可変レーザ（例えばアレキサンドライトレーザ、色素レーザ、自由電子レーザ等）を供給する蛍光用レーザ装置４と、通常照明光源３のランプ３ａからの白色光により内視鏡１で得られた通常観察像を第２アダプタ５を介して撮像する通常ＴＶカメラ６と、蛍光用レーザ装置４からの励起光λ０により内視鏡１で得られた蛍光像を第２アダプタ５を介して撮像する蛍光像撮像カメラ７と、通常ＴＶカメラ６により撮像された通常観察撮像信号を信号処理し通常画像を生成するＣＣＵ(カメラ･コントロール･ユニット）８と、蛍光像撮像カメラ７により撮像された蛍光撮像信号を信号処理し蛍光画像を生成する蛍光画像処理装置９

[0010]

The fluorescent observation endoscope apparatus of the 1st embodiment as a fluorescent-diagnosis apparatus should be shown in diagram 1.

The endoscope 1 which inserts intra-corporeal and obtains the usual observation image and the fluorescent observation images of an observation site, such as of an illness site, the laser apparatus for fluorescence 4 which supplies the usual illumination light source 3 and the variable-wavelength lasers for excitation (for example, an alexandrite laser, a dye laser, free electron laser, etc.) which supply white light for a usual observation to this endoscope 1 via the 1st adapter 2, the usual observation image obtained by the endoscope 1 according to white light from lamp 3a of the usual illumination light source 3, via the second adapter 5 becomes as follows.

The usual TV camera 6 for image-pick up, the fluorescent image image-pick-up camera 7 which records the fluorescent image obtained by the endoscope 1 by excitation-light (lambda)0 from the laser apparatus for fluorescence 4 via the second adapter 5, cCU8 which signal processes the usual observation image-pick-up signal recorded with the usual TV camera 6, and forms a usual image (camera * control * unit), the fluorescent image

と、蛍光画像処理装置９で信号処理される蛍光撮像信号の励起光より長い波長の蛍光光量を検出し疾患部位を識別するビデオスイッチングコントローラ１０と、通常画像及び蛍光画像を入力しビデオスイッチングコントローラ１０からの識別信号により通常画像または蛍光画像を出力するビデオスイッチャ１１と、ビデオスイッチャ１１からの出力画像を表示するモニタ１２と、蛍光用レーザ装置４より内視鏡１を介して照射されたレーザ光の反射光を受光してＣＣＵ８により得られた蛍光像より反射光の光量をモニタする反射光モニタ２７とを備えて構成される。

processing device 9 which signal processes the fluorescent image-pick-up signal recorded with the fluorescent image image-pick-up camera 7, and forms a fluorescent image, the video switching controller 10 which detects the fluorescent quantity of light of a wavelength longer than the excitation light of the fluorescent image-pick-up signal by which a signal processing is carried out by the fluorescent image processing device 9, and identifies the illness site, the video switcher 11 which inputs a usual image and a usual fluorescent image, and outputs a usual image or the usual fluorescent image with the identification signal from the video switching controller 10, via an endoscope 1 from the monitor 12 which displays the output image from the video switcher 11, and the laser apparatus for fluorescence 4, it has the reflected-light monitor 27 which monitors the quantity of reflected light, and it consists of the fluorescent image which receives the light of the reflected light of the irradiated laser light, obtained by CCU8.

【００１１】

第１アダプタ２は、ドライバ１３で可動ミラー１４を駆動することにより通常照明光源３のランプ３ａからの白色光と蛍光用レーザ装置４からの励起光λ０を切り換え（図１において、白色光の場合の可動ミラー１４の位置は実線、励起光λ０の場合の可動ミラー１４の位置は破線）、内視鏡１内を挿通するライトガイド１５に導光するよう

[0011]

The 1st adapter 2 switches excitation-light (lambda)0 from white light from lamp 3a of the usual illumination light source 3, and the laser apparatus for fluorescence 4 by actuating the movable mirror 14 by the driver 13.

(In diagram 1, the position of the movable mirror 14 in the case of white light is a continuous line. The position of the movable mirror 14 of an excitation-light (lambda)0 case is a broken line.)

A light-guide is carried out to the light guide

92	laser light source
100	angle control
106	fluorescent discrimination processor
108	superimposer
111	monitor

DERWENT

DERWENT TERMS AND CONDITIONS

Derwent shall not in any circumstances be liable or responsible for the completeness or accuracy of any Derwent translation and will not be liable for any direct, indirect, consequential or economic loss or loss of profit resulting directly or indirectly from the use of any translation by any customer.

Derwent Information Ltd. is part of The Thomson Corporation

Please visit our home page: "WWW.DERWENT.CO.UK" (English)
"WWW.DERWENT.CO.JP" (Japanese)

になっている。ライトガイド１５は第１アダプタ２からの光を内視鏡１の先端に伝送し、先端前方に照射するようになっている。照射された光による観察部位からの戻り光は観察像（通常観察像あるいは蛍光観察像）として内視鏡１内を挿通するイメージガイド１６により内視鏡１の接眼部１７に伝送される。

15 which passes through the inside of an endoscope 1.

A light guide 15 transmits the light from the 1st adapter 2 at the end of an endoscope 1.

It is designed to irradiate forwards.

The return light from the observation site by the irradiated light is transmitted to the eye-piece part 17 of an endoscope 1 by the image guide 16 which passes through the inside of an endoscope 1 as an observation image (usual observation image or fluorescent observation image).

【００１２】

接眼部１７には第２アダプタ５が着脱自在に接続されており、第２アダプタ５は、ドライバ１８で可動ミラー１９を駆動することにより通常観察像と蛍光観察像とを切り換え（通常観察像の場合の可動ミラー１９の位置は実線、蛍光観察像の場合の可動ミラー１９の位置は破線）、通常観察像を通常ＴＶカメラ６に、蛍光像を蛍光像撮像カメラ７に導く。通常ＴＶカメラ６では、内蔵するＣＣＤ２０により通常観察像を撮像し、通常観察撮像信号をＣＣＵ８に伝送する。そしてビデオスイッチングコントローラ１０からの識別信号により、ビデオスイッチャ１１を介してモニタ１２に通常観察像が表示される。

[0012]

The second adapter 5 is detachably connected to the eye-piece part 17.

For the second adapter 5, by actuating the movable mirror 19 by the driver 18, a usual observation image and fluorescent observation image are switched, and a usual observation image is guided to the usual TV camera 6, and a fluorescent image is guided to the fluorescent image image-pick-up camera 7. (The position of the movable mirror 19 in the case of a usual observation image is a continuous line.) The position of the movable mirror 19 in the case of fluorescent observation image is a broken line.

With the usual TV camera 6, a usual observation image is recorded by CCD20 built-in, and the usual observation image-pick-up signal is transmitted to CCU8.

And with the identification signal from the video switching controller 10, a usual observation image is displayed by monitor 12 via the video switcher 11.

【００１３】
蛍光像撮像カメラ７では、蛍光観察像を、波長λ１，λ２の光を透過する透過特性を有する２つの透過フィルタを有する回転フィルタ２１を介して、イメージ・インテンシファイヤ（Ｉ．Ｉ）２２で光増幅しＣＣＤ２３で撮像し、蛍光撮像信号を蛍光画像処理装置９に伝送する。そしてビデオスイッチングコントローラ１０からの識別信号により、ビデオスイッチャ１１を介してモニタ１２に蛍光観察像が表示される。尚、回転フィルタ２１は、円盤形状で、半円状の波長λ１，λ２の光を透過する透過特性を有する２つの透過フィルタから構成され、モータ２４により回転駆動されるようになっている。

[0013]
Via the rotating filter 21 which has two permeation filters which have the permeation characteristic which permeates fluorescent observation image wavelength (lambda)1, (lambda)2 light, with the fluorescent image image-pick-up camera 7, optical amplification is carried out by the image * intensifier (I.I) 22, and it records by CCD23.

A fluorescent image-pick-up signal is transmitted to the fluorescent image processing device 9.

And with the identification signal from the video switching controller 10, fluorescent observation image is displayed by the monitor 12 via the video switcher 11.

In addition, it consists of the two permeation filters which have the permeation characteristic whereby the rotating filter 21 permeates a disk shape and semicircle-like wavelength (lambda)1, (lambda)2 light.

Rotation actuation is carried out by the motor 24.

【００１４】
このように構成された蛍光観察内視鏡装置の作用について説明する。

[0014]
Thus an effect of the constituted fluorescent observation endoscope apparatus is demonstrated.

【００１５】
蛍光診断時には、まず、蛍光用レーザ装置４より励起光が連続的または段階的に波長変化させながら、内視鏡１を介して生体組織に照射される。生体組織からの励起光の反射光はイメージ

[0015]
At the time of fluorescent diagnosis, first, excitation light is continuously or in steps varied from the laser apparatus 4 for fluorescent use.

It is irradiated by the organism tissue via an endoscope 1.

The light reception of the reflected light of the

ガイド１６を介してＣＣＤ２０で受光され、ＣＣＵ８を介して反射光モニタ２７で励起光の反射光の光量がモニタされる。

excitation light from an organism tissue is carried out by CCD20 via the image guide 16.

The monitor of the quantity of reflected light of the light is carried out with the reflected-light monitor 27 via CCU8.

【００１６】

ここで、図２に励起光λ０を照射した時の蛍光特性を示す。例えば４４２ｍｍの励起光λ０で得られる組織の蛍光は、正常部位ではその強度が強く、病変部では、波長の短い側で正常に比べ弱い。つまり、図中λ１，λ２と正常と病変で蛍光強度の比率が異なるので、このλ１，λ２の比率を求めることで病変と正常を区別することができる。この病変と正常部の区別をより正確に行うためには、λ１とλ２の比率の差が大きくなる励起波長を選べば良い。しかしながら、組織表面には粘液や血液があり、その最適な励起波長は変動することがある。

[0016]

Here, the fluorescent characteristic when irradiating excitation-light (lambda)0 is shown in diagram 2.

For example, at the normal site, the strength of the fluorescence of the tissue obtained for 442 mm excitation-light (lambda)0 is strong.

It is weak at the side compared with short wavelengths at a disease part.

In other words, being (lambda)1, (lambda)2 in the drawing(s), since the ratio of fluorescence intensity differs at normal and disease sites, disease and normal are distinguishable by measuring this (lambda)1, (lambda)2 ratio.

In order to perform a distinction of this disease and a normal part more accurately, a wavelength is chosen for which the difference of the ratio of 1 (lambda) and 2 (lambda) becomes large.

However, the pituita and the blood are shown on the tissue surface, and the optimum excitation wavelength may be varied.

【００１７】

そこで、反射光モニタ２７は、励起光の反射光の光量をモニタすることにより、光量が最も少ない（すなわち、最も励起光の吸収の大きい）波長の励起光を検出し、蛍光用レーザ装置４に

[0017]

There, the reflected-light monitor 27 monitors the quantity of reflected light of the light. The excitation light of the wavelength with the lowest quantity of light is detected. (namely, the excitation light with the largest sorption)

A control signal is transmitted to the laser

制御信号を送信する。尚、このとき血液、粘液の反射特性をあらかじめ記憶しておき、このデータで補正することで、より精度を向上させることができる。

apparatus for fluorescence 4.
In addition, the reflective characteristic of the blood and the pituita is beforehand stored at this time.

By correcting by this data, the accuracy can be raised more.

【００１８】
蛍光用レーザ装置４は、反射光モニタ２７からの制御信号により、生体からの蛍光が最も大きい（すなわち、最も励起光の吸収が大きく、励起光の反射光の光量が最も少ない）波長の励起光を発振させる。

[0018]
The laser apparatus for fluorescence 4 has the largest fluorescence from the organism by the control signal from the reflected-light monitor 27 (that is, the sorption of excitation light is the largest).

The excitation light of the wavelength with the lowest quantity of reflected light of the light is oscillated.

【００１９】
そして、反射光モニタ２７で検出された励起光が例えば励起光λ０とすると、蛍光用レーザ装置４からは励起光λ０が供給され、生体組織は図２のような蛍光特性を有するので、回転フィルタ２１によりλ１，λ２の蛍光像を分離してＩ．Ｉ．２２で増幅しＣＣＤ２３で撮像する。

[0019]
And, if the excitation light detected with the reflected-light monitor 27 uses, for example, as excitation light (lambda) 0, excitation light (lambda) 0 will be supplied from the laser apparatus for fluorescence 4.

Since an organism tissue has a fluorescent characteristic as shown in Diagram 2, it separates the fluorescent image of (lambda)1, (lambda)2 with the rotating filter 21, amplifies it by I.I.22, and is recorded by CCD23.

【００２０】
尚、図１において、可動ミラー１４、１９はタイミングコントローラ２５により同期してドライバ1３、１８で駆動され、回転フィルタ２１を回転駆動するモータ２４の駆動タイミングも

[0020]
In addition, in Diagram 1, the movable mirrors 14 and 19 synchronize by the timing controller 25, and are actuated by drivers 13 and 18.

Actuation timing of the motor 24 which carries out rotation actuation of the rotating filter 21 is also controlled by the timing controller 25.

タイミングコントローラ２５により制御されている。

【００２１】
また、ビデオスイッチャ１１は、ビデオスイッチングコントローラ１０からの識別信号により、ＣＣＵ８からの通常画像または蛍光画像処理装置９からの蛍光画像をモニタ１２に出力するが、フットスイッチ２６によっても通常画像または蛍光画像の切り換えができるようになっている。

[0021]
Moreover, the video switcher 11 outputs the usual image from CCU8, or the fluorescent image from the fluorescent image processing device 9 to a monitor 12 with the identification signal from the video switching controller 10.

However, it is able to switch between a usual image or a fluorescent image also by foot switch 26.

【００２２】
また、励起光波長の選択、病変部と正常部の識別には、ファジィ制御、ＡＩ、ニューラルネット等を応用して行っても良い。さらに、γ線検出器を設けることで、病変部と正常部の識別精度を高めるように構成しても良い。

[0022]
Moreover, it may choose the excitation-light wavelength, and the identification of a disease part and a normal part by applying fuzzy control, AI, a neural net, etc.

Furthermore, by providing a gamma-ray detector, it may constitute so that the identification accuracy of a disease part and a normal part may be improved.

【００２３】
このように、第１実施例の蛍光観察内視鏡装置によれば、蛍光観察対象部位により、最も蛍光を発し易い波長の励起光を選択的に使用できるので、正確な蛍光診断を行うことができる。

[0023]
Thus, since the excitation light of the wavelength which tends to emit fluorescence can be selectively used by the fluorescent site for observation according to the fluorescent observation endoscope apparatus of the 1st embodiment, exact fluorescent diagnosis can be performed.

【００２４】
次に第２実施例について説明す

[0024]
Next the second embodiment is demonstrated.

る。図３及び図４は本発明の第２実施例に係わり、図３は蛍光観察内視鏡装置の構成を示す構成図、図４は図３の回転フィルタの構成を示す構成図である。第２実施例は第１実施例とほとんど同じであるので、異なる構成のみ説明し、同一構成には同じ符号をつけ説明は省略する。

Fig. 3 and 4 are concerned with the second embodiment of this invention.

Diagram 3 is a block diagram showing the composition of fluorescent observation endoscope apparatus. diagram 4 is a block diagram showing the composition of the rotating filter in the diagram 3.

Since the second embodiment is almost the same as the 1st embodiment, it demonstrates only different composition.

Attachment description omits the same code as the same composition.

【００２５】

図３に示すように、第２実施例では第１実施例の回転フィルタ２１の代わりに設けられた回転フィルタ２１ａと、反射光モニタ２７からの移動制御信号により回転フィルタ２１ａを回転駆動するモータ２４を回転フィルタ挿入径方向に移動する移動手段２８とを備えて構成される。

[0025]

It has rotation filter 21a provided instead of the rotating filter 21 of the 1st embodiment in the second embodiment as shown in diagram 3, and movement means 28 which moves the motor 24 which carries out rotation actuation of the rotating filter 21a with the movement-control signal from the reflected-light monitor 27 in the direction of the diameter of rotating filter insertion and it is constituted.

【００２６】

この回転フィルタ２１ａは、図４に示すように、円盤を半円に分割し、さらに内周側と外周側とに分割した４つの領域に異なる波長λ１，λ2，λ３，λ４の光を透過する透過特性を有する透過フィルタ３１、３２、３３、３４を備えて構成される。

[0026]

This rotating filter 21a divides a disk into semicircles, as shown in Diagram 4.

Furthermore it has the permeation filters 31, 32, 33, and 34 which have the permeation characteristic which permeates wavelength (lambda)1, (lambda)2, (lambda)3, (lambda)4 the light which differs in the four areas divided into the internal-circumference and periphery side, and it is constituted.

【００２７】

[0027]

そして、反射光モニタ２７からの移動制御信号に基づいて回転フィルタ２１ａを移動手段２８によりモータ２４を回転フィルタ挿入径方向に移動することで、例えば第１実施例で説明したように（図２参照）、反射光モニタ２７からの制御信号による蛍光用レーザ装置４の励起光レーザの波長がλ０の場合は、（モータ２４を紙面左に移動し）内周側に設けられた透過フィルタ３１、３２（透過波長λ１，λ2）を介して蛍光像を得、また、反射光モニタ２７からの制御信号による蛍光用レーザ装置４の励起光レーザの波長がλ０と異なる波長λ０’の場合は、（モータ２４を紙面右に移動し）この励起光λ０’による蛍光感度に適した（病変部と正常部における蛍光強度の比率の差が最大となる）外周側に設けられた透過フィルタ３３、３４（透過波長λ３，λ4）を介して蛍光像を得るようになっている。その他の構成、作用は第１実施例と同じである。

And, it is moving a motor 24 in the direction of the diameter of rotating filter insertion by the movement means 28 in rotating filter 21a based on the movement-control signal from the reflected-light monitor 27.

For example, it is like (diagram 2 reference) under description at the 1st embodiment. when the control signal from the reflected-light monitor 27, in the case where the wavelength of the excitation-light laser for fluorescence of the laser apparatus 4 is (lambda) 0, (Moving the motor 24 to the paper-surface left side) The permeation filters 31 and 32 (a fluorescent image is obtained via penetrated-wave length (lambda)1, (lambda) 2 provided in the internal-circumference side.

Moreover, by the control signal from the reflected-light monitor 27, in the case where it is wavelength (lambda) 0' in which the wavelength of the excitation-light laser for fluorescence of the laser apparatus 4 differs from (lambda) 0, (Moving motor 24 to the paper-surface right side) , provided on the periphery side suitable for the fluorescent sensitivity by this excitation-light (lambda) 0', permeation filters 33 and 34 (a fluorescent image is obtained via penetrated-wave length 4) (lambda)3, (lambda) 4, (The difference of the ratio of the fluorescence intensity in a disease part and a normal part serves as the maximum)

Other compositions and effects are the same as that of the 1st embodiment.

【００２８】

このように構成することで、第１実施例の効果に加え、反射光

[0028]

With such a constitution, adding to the effect of the 1st embodiment.

モニタ２７からの制御信号による蛍光用レーザ装置４の励起光による蛍光像を、反射光モニタ２７からの移動制御信号に基づいて回転フィルタ２１ａを移動手段２８によりモータ２４を回転フィルタ挿入径方向に移動させることで観察するので、励起光波長に応じて蛍光波長を選択することができ、より精度の高い蛍光診断を行うことができる。

The fluorescent image by the excitation light of the laser apparatus for fluorescence 4 by the control signal from the reflected-light monitor 27, since rotating filter 21a is observed by making motor 24 move in the direction of the diameter of rotating filter insertion by the movement means 28 based on the movement-control signal from the reflected-light monitor 27, a fluorescent wavelength can be chosen depending on the excitation-light wavelength, and more accurate fluorescent diagnosis can be performed.

【００２９】
尚、上記の第２実施例では、反射光モニタ２７により選択された特定波長の励起光に応じて蛍光波長を選択するとしたが、これに限らず、例えば特定波長の励起光に対して、透過フィルタ３１、３２（透過波長λ１，λ2）を介した観察と、透過フィルタ３３、３４（透過波長λ３，λ4）を介した観察との両方を行い蛍光診断を行うようにしても良い。また、透過フィルタ３１、３２（透過波長λ１，λ2）及び透過フィルタ３３、３４（透過波長λ３，λ4）を介した両方の観察を複数の波長の励起光に対して行うようにしても良い。このようにすることで、蛍光観察対象部位からの蛍光像データを増やすことが可能となり、より正確な蛍光診断を行うことができる。

[0029]
In addition, in the above-mentioned second embodiment, it was presupposed that a fluorescent wavelength is chosen depending on the excitation light of the specific wavelength chosen with the reflected-light monitor 27.

However, it does not restrict to this, for example, in relation to the excitation light of a specific wavelength, permeation filters 31 and 32 (observation through penetrated-wave length (lambda)1, (lambda) 2, and by permeation filters 33 and 34 (performing observation through penetrated-wave length (lambda)3, (lambda) 4, it may be made to perform fluorescent diagnosis.

Moreover, with permeation filters 31 and 32 (attaining penetrated-wave length (lambda)1, (lambda) 2, permeation filters 33 and 34 (observation through penetrated-wave length (lambda)3, (lambda) 4 to the excitation light of some wavelengths), by performing like the above, it is enabled to increase the fluorescent image data from the fluorescent site for

observation, and more exact fluorescent diagnosis can be performed.

【００３０】
ところで、イメージ・インテンシファイヤ（Ｉ．Ｉ．）２２を内視鏡１の接眼部１７に接続して蛍光像を観察する場合、Ｉ．Ｉ．２２の重さが内視鏡１の操作部にかかり、かつ、Ｉ．Ｉ．２２は大型であるので操作性が悪いと言う問題や、Ｉ．Ｉ．２２が精密な電気部品から成り、滅菌性が悪いと言う問題がある。

[0030]
When the image * intensifier (I. I.) 22 is connected to the eye-piece part 17 of an endoscope 1 by the way, and it observes a fluorescent image, the weight of I.I.22 is applied to the operating part of endoscope 1.
I.I.22 being large-sized , the problem that operativity is bad, i. I.22 consists of a precise electric component, and there is a problem that sterilization property is bad.

【００３１】
そこで、イメージガイドをポリマー光ファイバーで構成して励起光を導光し、光ファイバーアンプ機能を加えることで、イメージ・インテンシファイヤなしで、自家蛍光を観察できるので操作性や滅菌性が向上しより正確で安全な蛍光診断を行うことのできる蛍光観察内視鏡装置の実施例を次に説明する。

[0031]
Then, an image guide is constituted from a polymer optical fibre, and the light-guide of the excitation light is carried out.
Since a self-fluorescence can be observed without an image * intensifier by adding optical-fibre amp function, the embodiment of the fluorescent observation endoscope apparatus whereby operativity and sterilization property can improve and can perform more exact and safe fluorescent diagnosis is demonstrated below.

【００３２】
イメージ・インテンシファイヤなしで蛍光診断を行うことのできる一実施例の蛍光観察内視鏡装置は、図５に示すように、白色光又はレーザ光を切り換えて出射する光源４１と、前記白色

[0032]
The fluorescent observation endoscope apparatus of one embodiment which can perform fluorescent diagnosis without an image * intensifier irradiates the light source 41 which switches and carries out the radiation of white light or the laser light, and above-mentioned

光又はレーザ光を体腔内に照射し、組織の通常画像又は蛍光画像を観察する内視鏡４２と、前記通常画像又は蛍光画像を同一画面にスーパーインポーズしたり、蛍光画像により得られた画像擬似カラー処理等を行い、病変部を認識しやすくする画像処理装置４３と、前記内視鏡４２内を挿通するＩＧ（イメージガイド）４５と光学的に結合し蛍光を増幅するためのポンピング光を発生するアンプ用励起光源４６と、前記蛍光像及び通常像を切り換えるため光源４１と画像処理装置４３とアンプ用励起光源４６及び内視鏡４２の操作部４４に内蔵された回転フィルタ４７を回転駆動するモータ４８を制御するタイミングコントローラ５０と、前記画像処理装置４３で処理された画像を表示するモニタ５１とから構成されている。

white light or a laser light, intra-corporeal, as shown in diagram 5.

The endoscope 42 which observes the usual image or the usual fluorescent image of a tissue, and the above-mentioned usual image or the above-mentioned usual fluorescent image is superimposed on the same screen.
Moreover, an image pseudo-colour process obtained by the fluorescent image is performed.
The excitation source for amps 46 which generates the pumping light for bonding with the image processing device 43 which make a disease part easy to recognize, and IG (image guide)45 which passes through the inside of the above-mentioned endoscope 42, optically, and amplifying the fluorescence, in order to switch the above-mentioned fluorescent image and the above-mentioned fluorescent usual image, the timing controller 50 which controls the motor 48 which carries out rotation actuation of the rotating filter 47 built into operating part 44 of a light source 41, the image processing device 43, the excitation source for amps 46, and the endoscope 42, the monitor 51 which displays the image processed by the above-mentioned image processing device 43.

It consists of these.

【００３３】
前記光源４１は、白色光を発生するＸｅランプ５２と蛍光を励起するためのＨｅ－Ｃｄレーザ５３とが内蔵され、ミラー５４及びレンズ５５、５６を介したＸｅランプ５２からの白色光とＨｅ－Ｃｄレーザ５３からの励

[0033]
The Xe lamp 52 with which the above-mentioned light source 41 generates white light, and the He-Cd laser 53 for exciting fluorescence is built in.
White light from the Xe lamp 52 and the excitation light from the He-Cd laser 53 through the mirror 54 and the lenses 55 and 56 are

起光とが光学ミラー５７により切り換えられ、内視鏡４２のライトガイドケーブル５７及び内視鏡４２の挿入部５８内に挿通されたＬＧ（ライトガイド）５９に導光される。

switched by the optical mirror 57.

A light-guide is carried out to LG (light guide)59 passed through the light-guide cable 57 of an endoscope 42, and the insertion part 58 of an endoscope 42.

【００３４】

前記内視鏡４２の先端には、前記ＬＧ５９により前記光源４１からの白色光又は励起光を体腔内に導かれ出射した光を均一に拡げて照射する拡散レンズ６０と、通常画像又は蛍光像を撮像する対物レンズ６１とが設けられている。

[0034]

The diffusion lens 60 which white light or the excitation light from the above-mentioned light source 41 is guided intra-corporeal by the above-mentioned LG59, and extends uniformly the light which radiated and irradiates it, and the objective lens 61 which records a usual image or a usual fluorescent image are provided at the end of the above-mentioned endoscope 42.

【００３５】

また、操作部４４内には、蛍光像又は通常像を伝送又は増幅する挿入部５８内を挿通するＩＧ４５により伝送された画像を撮像するＣＣＤ６２が内蔵され、蛍光像又は通常像はレンズ６３によりＣＣＤ６２の撮像面に投影される。また、蛍光像を増幅するためＩＧ４５の両端には励起光のみを反射するダイクロイックミラー６４，６５が配置され、アンプ用励起光源４６からのアンプ用励起光を光ファイバ６６を介してＩＧ４５に入射するためのレンズ６７，６８とハーフミラー６９が配置されている。

[0035]

Moreover, in an operating part 44, CCD62 which records the image transmitted by IG45 which passes through the inside of the insertion part 58 which transmits or amplifies a fluorescent image or a fluorescent usual image is built in.

A fluorescent image or a usual image is projected by the image-pick-up surface of CCD62 with a lens 63.

Moreover, in order to amplify a fluorescent image, the dichroic mirrors 64 and 65 which reflect only excitation light in the ends of IG45 are configured.

The lenses 67 and 68 and the one-way mirror 69 for carrying out incidence of the excitation light for amps from the excitation source for amps 46 to IG45 via an optical fibre 66 are configured.

【００３６】
ここでＩＧ４５は、”Ｒｈｏｄａｍｉｎｅ　６Ｇ”，”Ｐｅｒｙｌｅｎｅ　Ｒｅｄ”がドープされたポリマー光ファイバより構成される。

[0036]
IG45 consists of the polymer optical fibre to which the dope of the "Rhodamine 6G", "Perylene Red" was carried out here.

【００３７】
さらに前記回転フィルタ４７は、レンズ６３とＣＣＤ６２の間に設けられており、タイミングコントローラ５０でモータ４８を制御することで回転フィルタ４７を回転させ、例えば蛍光像の時は透過フィルタ（透過波長λ1）７１，透過フィルタ（透過波長λ2）７２を通し、通常画像の時は何もフィルタが入っていない領域７３を通しそのまま通過させる。つまり、モータ４８は、前記タイミングコントロール５０により制御され、回転フィルタ４７のフィルタを順次切り換える。

[0037]
Furthermore the above-mentioned rotating filter 47 is provided between lens 63 and CCD62.

The rotating filter 47 is rotated by controlling a motor 48 by the timing controller 50.

For example, the permeation filter (penetrated-wave length 1 (lambda)) 71 and the permeation filter (penetrated-wave length 2 (lambda)) 72 are passed through at the time of a fluorescent image.

The area 73 in which the filter is not contained at all is passed through at the time of a usual image, and it is made to pass through it as it is.

In other words, motor 48 is controlled by the above-mentioned timing control 50.

The filter of the rotating filter 47 is sequentially switched.

【００３８】
前記アンプ用励起光源４６は、ＹＡＧレーザ７４と前記ＹＡＧレーザ７４からの光の第２高調波を発生するＳＨＧ７５より構成される。

[0038]
The above-mentioned excitation source for amps 46 consists of SHG75 which generates the second higher harmonics of the light from YAG laser 74 and above-mentioned YAG laser 74.

【００３９】
このように構成された本実施例

[0039]
Thus in this constituted embodiment, LG59 of

では、まず光源４１より白色光又は励起光を内視鏡４２のＬＧ５９を通じ、例えば、胃、大腸、気管支、膀胱などの体腔内あるいは腹腔，胸腔に導光する。

an endoscope 42 is first passed in white light or excitation light from a light source 41.

For example, the light is guided to intra-corporeal region, such as the stomach, large intestine, a bronchus, and the vesica urinaria, or the abdominal cavity, and the thoracic cavity.

【００４０】

白色光を照射した場合、体腔内の像を対物レンズ６１，ＩＧ４５、さらに回転フィルタ４７のうち何もフィルタが入っていない領域７３を通過し、ＣＣＤ６２で撮影し、画像処理装置４３の図示しない画像メモリに一時蓄積された後、モニタ５１に表示する。

[0040]

When irradiating white light, it passes through the area 73 in which the filter is not contained at all among the rotation filters 47 furthermore an objective lens 61 and IG45 in the image intra-corporeal, and a photograph is taken by CCD62.

After carrying out temporary storage to the image memory of an image processing device 43 not illustrated, it displays in the monitor 51.

【００４１】

一方、励起光を照射した場合、例えばＨｅ－Ｃｄレーザ５３の４４２ｎｍの光を生体組織に照射すると、正常組織からは、フラビンに関連する緑色の蛍光を発するが、異常組織、例えば癌組織からは緑色領域の蛍光強度が落ちた暗い黄色ぽい蛍光に変わる。

[0041]

If the 442 nm light of the He-Cd laser 53 is irradiated to an organism tissue on the one hand when irradiating excitation light, the green fluorescence relevant to flavin will be emitted from a normal tissue.

However, it changes to the dark yellow fluorescence from which the fluorescence intensity of a green region fell out, due to an abnormal structure, for example, cancer tissue.

【００４２】

この蛍光を白色光同様ＩＧ４５で受けるが、その蛍光強度が極めて微弱であるため、このままではＣＣＤ６２では撮像できない。そこで、アンプ用励起光源４６内のＹＡＧレーザ７４より

[0042]

This fluorescence is received by IG45 like white light.

However, since the fluorescence intensity is very slight, with this, it cannot image-pick up by CCD62.

Then, a 1064 nm light is generated from YAG

１０６４ｎｍの光を発生させ、さらにＳＨＧ７５により、５３２ｎｍの光に変換し、これを、光ファイバ６６を通じ、レンズ６７，６８でビームを均一に拡げ、ハーフミラー６９を介しＩＧ４５に入射する。

laser 74 in the excitation source for amps 46.
Furthermore by SHG75, transformation is carried out to a 532 nm light.
An optical fibre 66 passes this, and the beam is uniformly extended by lenses 67 and 68.

Incidence is carried out to IG45 via a one-way mirror 69.

【００４３】
ＩＧ４５は、上述したように、”Ｒｈｏｄａｍｉｎｅ　６Ｇ”，”Ｐｅｒｙｌｅｎｅ　Ｒｅｄ”がドープされたポリマー光ファイバより成り、５３２ｎｍの励起光を入射した場合、”Ｒｈｏｄａｍｉｎｅ　６Ｇ”に対応する５７１ｎｍの蛍光と、”Ｐｅｒｙｌｅｎｅ　Ｒｅｄ”に対応する６２１ｎｍの蛍光を増幅する。この時、増幅率は６００～２０００倍となる。

[0043]
IG45 consists of the above-mentioned polymer optical fibre to which the dope of the "Rhodamine 6G", "Perylene Red" was carried out.

The 571 nm fluorescence which corresponds 532 nm excitation light for "Rhodamine 6G" in an incident case, and the 621 nm fluorescence corresponding to "Perylene Red" are amplified.

At this time, gain becomes 600 - 2000 times.

【００４４】
そして、増幅された蛍光に対して、回転フィルタ４７の透過フィルタ７１、７２で波長λ１（例えば５７１ｎｍ），波長λ２（例えば６２１ｎｍ）の蛍光を取り出し、雑音を抑え、ＣＣＤ６２で各々撮像する。この画像を画像処理装置４３内の図示しない画像メモリ及び演算装置により正常部と病変部を判別する。

[0044]
And, the fluorescence of a wavelength (lambda) 1 (for example, 571 nm) and the wavelength (lambda) 2 (for example, 621 nm) is extracted with the permeation filters 71 and 72 of the rotating filter 47 in relation to the amplified fluorescence.
Noise is restrained, and it records respectively by CCD62.

A normal part and a disease part are distinguished for this image with the image memory and the calculating unit in an image processing device 43 not illustrated.

【００４５】
上記通常画像，蛍光画像は、タイミングコントローラ５０で順次切り換えられ、モニタ５１に個別あるいは同時（スーパーインポーズ）に表示される。

[0045]
The above-mentioned usual image and a fluorescent image are sequentially switched by timing controller 50.

Monitor 51 displays individually or simultaneously (superimposition).

【００４６】
このように本実施例によれば、Ｈｅ－Ｃｄレーザ５３の４４２ｎｍの光を生体組織に照射し、異常組織からの蛍光のうちで、ポリマー光ファイバより成るＩＧ４５で、Ｒｈｏｄａｍｉｎｅ ６Ｇ”に対応する５７１ｎｍの蛍光と、”Ｐｅｒｙｌｅｎｅ Ｒｅｄ”に対応する６２１ｎｍの蛍光とを６００～２０００倍に増幅し、回転フィルタ４７で波長λ １（例えば５７１ｎｍ），波長λ ２（例えば６２１ｎｍ）の蛍光を取り出し、雑音を抑え、ＣＣＤ６２で各々撮像するので、イメージ・インテンシファイヤなしで自家蛍光を観察でき、操作性や滅菌性が向上し、より正確で安全な蛍光診断を行うことができる。

[0046]
Thus according to this embodiment, the 442 nm light of the He-Cd laser 53 is irradiated to an organism tissue.

Among the fluorescent inside an abnormal structure, by IG45 which consists of a polymer optical fibre, the 571 nm fluorescence corresponding to Rhodamine 6G" and the 621 nm fluorescence corresponding to "Perylene Red" are amplified to 600 - 2000 times.

The fluorescence of a wavelength (lambda) 1 (for example, 571 nm) and the wavelength (lambda) 2 (for example, 621 nm) is taken out with the rotating filter 47.

The noise is restrained, and since it records respectively by CCD62, a self-fluorescence can be observed without an image * intensifier.

Operativity and sterilization property improve.

More exact and safe fluorescent diagnosis can be performed.

【００４７】
尚、アンプ用励起光源４６で用いられるレーザは、ＹＡＧレーザとしたが、これに限らず、半導体レーザ，アルゴンレーザ，エキシマレーザでもよい。

[0047]
In addition, the laser used by the excitation source for amps 46 was taken as the YAG laser.

However, it may not restrict to this but a semiconductor laser, an argon laser, and an excimer laser are possible.

【００４８】
また、Ｈｅ－Ｃｄレーザ５３の４４２ｎｍの光を生体組織に照射し、生体組織からの蛍光をポリマー光ファイバより成るＩＧ４５で増幅して自家蛍光を観察し、病変部の診断を行うとしたが、これに限らず、蛍光物質としての、例えばＨｐＤ（ヘマトポルフィリン），Ｐｈｏｔｏｆｒｉｎ，ＡＬＡ（δ－ａｍｉｎｏ　ｌｅｖｕｌｉｎｉｃ　ａｃｉｄ），ＮＰｅ$_6$，ＢＰＤ，ＳｎＥＴ２は癌への集積性があるので、これを生体内に注入し、前記蛍光物質からの蛍光をポリマー光ファイバより成るＩＧ４５で増幅して観察することで疾患部位を診断してもよい。

[0048]
Moreover, the 442 nm light of the He-Cd laser 53 is irradiated to an organism tissue.
The fluorescence from an organism tissue is amplified by IG45 which consists of a polymer optical fibre, and self-fluorescence is observed.
The disease part is diagnosed.
However, it does not restrict to this, but it is as a fluorescent material, for example, since HpD (hematoporphyrin) and Photofrin, ALA((delta)-amino levulinic acid), NPe6, BPD, SnET2 have the accumulation property towards cancer, they inject this in the living body.
An illness site may be diagnosed by amplifying and observing the fluorescence from the above-mentioned fluorescent material by IG45 which consists of a polymer optical fibre.

【００４９】
図６は図５の実施例の変形例である。図５の実施例ではポリマー光ファイバ束をＩＧ５５として内蔵した蛍光観察用の内視鏡を用いた構成であったが、このような内視鏡は特殊であり、高価な内視鏡となるので、この変形例の蛍光観察内視鏡装置は、通常の内視鏡を用いイメージ・インテンシファイヤなしで自家蛍光の観察ができる構成となっている。本変形例は図５の実施例とほとんど同じであるので、異なる構成のみ説明し、同一の

[0049]
Diagram 6 is the modification of the embodiment of diagram 5.
It was the composition using the endoscope for fluorescent observation which built into polymer optical-fibre bundle as IG55 in the embodiment in the diagram 5.
However, such an endoscope is special, and since it becomes an expensive endoscope, the fluorescent observation endoscope apparatus of this modification serves as the composition that an observation of self-fluorescence can be performed without an image * intensifier using a usual endoscope.
Since this modification is almost the same as

構成には同じ符号をつけ説明は省略する。

the embodiment of diagram 5, it demonstrates only different composition, and the same code for identical compositions is attached and description is omitted.

【００５０】
すなわち、図６に示すように、図５の変形例である蛍光観察内視鏡装置は、通常観察像を伝送するイメージガイド４５ａを挿通した通常の内視鏡８１と、ポリマー光ファイバ束８２を内視鏡８１の接眼部８３と蛍光像撮像装置８４とを結ぶ、結合装置８５に内蔵している。蛍光像撮像装置８４は、ＹＡＧレーザ７４、ＳＨＧ７５、回転フィルタ４７等から構成され、ＳＨＧ７５からの光はミラー８６を介してハーフミラー６９に導光されるようになっている。ポリマー光ファイバ束８２は、図５の実施例と同様に、”Ｒｈｏｄａｍｉｎｅ　6Ｇ”，”Ｐｅｒｙｌｅｎｅ　Ｒｅｄ”がドープされたポリマー光ファイバより構成されている。その他の構成、作用は図５の実施例を同じである。

[0050]
Namely, for the fluorescent observation endoscope apparatus which is the modification of diagram 5 as shown in Diagram 6, the usual endoscope 81 which passed through image guide 45a which transmits a usual observation image, the eye-piece part 83 and the fluorescent image image-pick-up apparatus 84 of an endoscope 81 are built in to the polymer optical-fibre bundle 82 in the joint apparatus 85. The fluorescent image image-pick-up apparatus 84 consists of YAG laser 74, SHG75, a rotating filter 47, etc.

The light-guide of the light from SHG75 is carried out to a one-way mirror 69 via mirror 86.

The polymer optical-fibre bundle 82 consists of the polymer optical fibre to which the dope of the "Rhodamine6G", "Perylene Red" was carried out, like the embodiment of diagram 5.

Other compositions and the effect are the same in the embodiment of diagram 5.

【００５１】
このように構成された本変形例によれば、図５の実施例の効果に加え、ポリマー光ファイバ束８２を内蔵した結合装置８５を内視鏡８１の接眼部８３と蛍光

[0051]
Thus according to this constituted modification, adding to the effect of the embodiment in the diagram 5, since it loads with the joint apparatus 85 which contained the polymer optical-fibre bundle 82, between the eye-piece

像撮像装置８４との間に装着して構成しているので、通常の内視鏡が使用でき、安価にイメージ・インテンシファイヤなしで自家蛍光の観察ができる蛍光観察内視鏡装置が実現できる。尚、図５及び図６に示す実施例において、図１ないし図４に示す実施例のようにＨｅ－Ｃｄレーザを波長可変レーザに置き換え反射光をモニタし、これにより最適な波長を選択することで、より精度の高い診断が可能となる。

part 83 of an endoscope 81, and the fluorescent image image-pick-up apparatus 84 and it is constituted, a usual endoscope can be used, and the fluorescent observation endoscope apparatus by which an observation of a self-fluorescence is cheaply made without an image * intensifier is realizable.

In addition, in the embodiment shown in Fig. 5 and 6, a He-Cd laser is substituted by a variable-wavelength laser like the embodiment shown in Fig. 1 or 4, and the monitor of the reflected light is carried out.

By choosing the optimum wavelength this way, a more accurate diagnosis can be performed.

【００５２】

ところで、蛍光観察内視鏡装置による蛍光像の観察では、術者が内視鏡湾曲操作を手動で行い、蛍光像を目で確認しながら行っていた。そのため、蛍光を目で確認しながら、病変部をスクリーニングする場合、そのスクリーニングのために術者は慎重にアングルを操作したり又は、蛍光の違いが微妙かつ微少である場合患部を見落とす可能性がある。

[0052]

By the way, by observation of the fluorescent image by the fluorescent observation endoscope apparatus, an operator performs endoscope curvature operation manually.

It was being carried out, confirming the fluorescent image by the eye.

Therefore, when the screening of the disease part is carried out, confirming the fluorescence by the eye, an operator may change the angle carefully for screening, or a diseased part may be overlooked when the fluorescent difference is slight and very small.

【００５３】

そこで、微妙かつ微少な蛍光の違いを検出し患部のある所でアングルを止めるようにすることで操作性の向上及び確実な病変の検出ができる蛍光観察内視鏡

[0053]

Then, the embodiment of the fluorescent observation endoscope apparatus to which the improvement in operativity and the detection of a reliable disease are made by stopping the angle at the place which detects a slight and

装置の実施例について次に説明する。

very small fluorescent difference, and has a diseased part is demonstrated below.

【００５４】

微妙かつ微少な蛍光の違いを検出し患部のある所でアングルを止める蛍光観察内視鏡装置の一実施例の構成は、図７に示すように、通常の観察のための白色光を発生する光源装置９１と、蛍光観察のための励起光を発生するレーザ光源９２と、白色光または励起光を先端部９３ａより患部に照射し患部を観察する内視鏡９３とを備えて構成される。

[0054]

The composition of one embodiment of the fluorescent observation endoscope apparatus which stops the angle at the place which is detected a delicate and very small fluorescent difference, and has a diseased part is shown in diagram 7.

It has the light source device 91 which generates white light for a usual observation, the laser light source 92 which generates the excitation light for fluorescent observation, and the endoscope 93 which irradiates white light or excitation light from end 93a to the diseased part, and observes the diseased part.

【００５５】

内視鏡９３の操作部９４より延出したライトガイドケーブル９５の先端は、前記光源装置９１及びレーザ光源９２が接続された、白色光と励起光を切り換えて内視鏡９３のライトガイドケーブル９５及び挿入部９６内を挿通する図示しないライトガイドに導光する第１のアダプタ９７に着脱自在に接続されている。

[0055]

Concerning the end of the light-guide cable 95 extended from the operating part 94 of an endoscope 93, the above-mentioned light source device 91 and the above-mentioned laser light source 92 were connected. It connects with the first adapter 97 which carries out a light-guide to the light guide which switches white light and excitation light and passes through the inside of the light-guide cable 95 of an endoscope 93, and the insertion part 96 detachably, not illustrated.

【００５６】

内視鏡９３の操作部９４には、図示しない電動モータによる電動アングル９８が内蔵されており、挿入部９６の先端側に設け

[0056]

The electrically driven angle 98 by the electric motor not illustrated is built into operating part 94 of endoscope 93.

Curved part 99 provided on the end side of

られた湾曲部９９を湾曲駆動するようになっている。この電動アングル９８は、例えば２本のアングルワイヤ及び電動モータ（図示せず）とから構成され、ライトガイドケーブル９５を介してアングル制御部１００により湾曲駆動が制御されるようになっている。図示しないアングルワイヤ及び電動モータにより湾曲部９９を上下左右に湾曲させ内視鏡９３の先端部９３ａを所望の方向に向けることができるようになっている。

insertion part 96 is actuated.
This electrically driven angle 98 consists of two angle wires and an electric motor (not shown), for example.

The curvature driving controls by the angle control part 100 via the light-guide cable 95.

A curved part 99 can be curved vertically and horizontally by the angle wire and the electric motor not illustrated, and end 93a of an endoscope 93 can be turned now in the desired direction.

【００５７】
そして、内視鏡９３により体腔内１０１の病変部１０２及びその周辺部の蛍光像及び通常像を検出し、Ｉ．Ｉ．１０３とＣＣＤカメラ１０４各々を撮像する。このとき、蛍光像及び通常像は、第２のアダプタ１０５で各々、Ｉ．Ｉ．１０３とＣＣＤカメラ１０４に振り分けられる。

[0057]
And, an endoscope 93 detects the disease part 102 intra-corporeal 101, the fluorescent image of the periphery part, and a usual image.

I. I.103, and cCD camera 104 each is recorded.

At this time, the 2nd adapter 105 can distribute the fluorescent image and a fluorescent usual image to each I.I.103 and CCD camera 104.

【００５８】
Ｉ．Ｉ．１０３で撮像された蛍光像は、蛍光診断処理部１０６で処理され正常部と異常部を判別される。ＣＣＵ１０７は、ＣＣＤカメラ１０４で撮像された通常像より通常画像を生成する。前記蛍光診断処理部１０６と、ＣＣＵ１０７で得られた画

[0058]
The fluorescent image recorded by I.I.103 is processed in the fluorescent-diagnosis processor 106, and a normal part and an abnormal part are distinguished.

CCU107 forms a usual image from the usual image recorded with CCD camera 104.
The above-mentioned fluorescent-diagnosis processor 106 and the image obtained by

像は、スーパーインポーズ１０８で切り換え又は同一画面に合成され、スーパーインポーズ１０８からの出力画像、例えば親画像を通常画像１０９とし子画像を蛍光画像１１０とした合成画像がモニタ１１１に表示されるようになっている。

CCU107 are synthesised by a switching or by on same screen by superimposition 108.

The synthetic image which made it the usual image 109, the output image, for example, parent image, from superimposition 108, and made the child image the fluorescent image 110 displays on monitor 111.

【００５９】

尚、モニタ１１１に表示される合成画像は、これに限らず、親画像を蛍光画像とし子画像を通常画像としてもよく、子画像の表示位置も任意に設定できる。さらに、モニタ１１１が表示する画像は、このような合成画像に限らず、蛍光画像あるいは通常画像のみの表示、あるいはこれらの画像を画像処理した処理画像を表示することができる。

[0059]

In addition, the synthetic image displayed on monitor 111 is not restricted to this, and can make the parent image a fluorescent image. It can also make the child image a usual image.

The display position of the child image can also be set up arbitrarily.

Furthermore, the image which monitor 111 displays is not restricted to such a synthetic image. The display of only a fluorescent image or a usual image or the processed image which carried out the image processing of these images can be displayed.

【００６０】

このように構成された図７の実施例では、まず、内視鏡９３の先端部９３ａを体腔内１０１（例えば、肺，食道，胃，腸，膵胆管，膀胱，尿管，腹腔，胸腔，子宮）に配置する。光源装置９１又はレーザ光源９２の光をアダプタ９７により順次内視鏡９３を介し、体腔内１０１に照射する。この時の通常画像、蛍光画像は各々アダプタ１０５で切り換えられ、Ｉ．Ｉ．１０

[0060]

Thus in the embodiment of the constituted diagram 7, end 93a of an endoscope 93 is first configured to intra-corporeal 101 (for example, lungs, an esophagus, the stomach, intestines, the pancreatic bile duct, the vesica urinaria, the ureter, an abdominal cavity, a thoracic cavity, the womb).

The light of the light source device 91 or the laser light source 92 is sequentially irradiated to intra-corporeal 101 via an endoscope 93 by the adapter 97.

The usual image at this time and a fluorescent

３又はＣＣＤカメラ１０４で撮影される。

image are switched by each adapter 105.

A photograph is taken with I.I.103 or the CCD camera 104.

【００６１】
この時、蛍光像においては、正常部に対し病変部１０２では、その強度及び波長特性が変化する。つまり、蛍光強度又は波長特性を蛍光診断処理部１０６で処理することで病変部１０２を判別できる。

[0061]
At this time, the strength and wavelength characteristics vary in the disease part 102 and normal part in a fluorescent image.

In other words, the disease part 102 can be distinguished by processing a fluorescence intensity or a wavelength characteristic in the fluorescent-diagnosis processor 106.

【００６２】
一方、内視鏡９３では、アングル制御部１００により電動アングル９８を駆動し、内視鏡９３の湾曲部９９を操作し、体腔内１０１を観察する。この時、蛍光診断処理部１０６で病変部１０２を発見した場合、その病変部１０２が内視鏡９３の視野の中心に来るよう電動アングル９８を制動し、中央部に来た時点で湾曲駆動を停止させ、例えばモニタ表示あるいは音声情報として術者に病変部１０２の存在を知らせる。

[0062]
On the one hand, in an endoscope 93, the electrically driven angle 98 is actuated by the angle control part 100.

The curved part 99 of an endoscope 93 is operated, and the intra-corporeal 101 is observed.

When the disease part 102 is discovered in the fluorescent-diagnosis processor 106 at this time, the damping of the electrically driven angle 98 is carried out so that the disease part 102 may come to the center of the visual field of endoscope 93.

When coming to the center section, curvature change is stopped.

For example, the operator is told about existing of the disease part 102 via the monitor display or by vocal information.

【００６３】
このように、図７の実施例によれば、蛍光診断処理部１０６で病変部１０２を判別し病変部１

[0063]
Thus, when according to the embodiment of diagram 7 the disease part 102 is distinguished in the fluorescent-diagnosis processor 106 and

０２を発見した場合、アングル制御部１００により電動アングル９８を制動し、中央部に来た時点で湾曲駆動を停止させ、術者に病変部１０２の存在を知らせるので、微妙かつ微少な蛍光の違いを検出し患部のある所でアングルを止めるようにすることができ、操作性を向上させると共に確実に病変部を検出することができる。

the disease part 102 is discovered, the damping of the electrically driven angle 98 is carried out by the angle control part 100.

When coming to the center section, curvature change is stopped.

Since the operator is told about existing of the disease part 102, the angle can be stopped at the place which detects a delicate and very small fluorescent difference, and has a diseased part.

Thereby, the disease part is reliably detectable while raising operativity.

【００６４】

尚、上記各実施例では通常画像を撮像する通常ＴＶカメラのＣＣＤを白色光に基づいて撮像するとしたが、このＣＣＤは入射面にカラーモザイクフィルタを設けることでカラー画像を撮像するＣＣＤとすることができる。また、白色光をＲ，Ｇ，Ｂに分離するカラーフィルタを設けることでカラー画像を撮像する通常ＴＶカメラとしても良いし、通常照明光源からＲ，Ｇ，Ｂの照明光を順次供給するようにし、この供給タイミングに同期させることでカラー画像を撮像する通常ＴＶカメラとしても良い。

[0064]

In addition, in each embodiment, it was presupposed that CCD of the usual TV camera which records a usual image is recorded based on white light.

However, this CCD can be taken as CCD which records a colour image by providing a colour mosaic filter in the plane of incidence.

Moreover, it is good also as a usual TV camera which records a colour image by providing the colour filter which separates white light into R, G, and B.

It is sequentially made to supply the illumination light of R, G, and B from the usual illumination light source.

It is good also as a usual TV camera which records a colour image while making it synchronize with this supply timing.

【００６５】

また、上述したように、通常、励起光源として単色光を発生するレーザ光が使われる。しかし、

[0065]

Moreover, the above-mentioned laser light which generates monochromatic light as an excitation source as usual is used.

レーザ光源は高価であると言う問題がある。そこで、図８に示すように、Ｘｅランプの白色光より励起光を効率良く選び出す励起光フィルタ１２０を用いるようにしても良い。

However, there is a problem that the laser light source is expensive.

Then, as shown in diagram 8, it may be made to use the excitation-light filter 120 which selects excitation light out of white light from an Xe lamp efficiently.

【００６６】

すなわち、図８のように、励起光フィルタ１２０は、Ｘｅランプ１２１からの白色光に対して、干渉膜が蒸着された励起光λ０のみを通過する干渉フィルタ１２２、１２３と、その干渉フィルタ１２２、１２３に狭まれて配置された励起光λ１以外の光を吸収する色フィルタ１２４より構成される。

[0066]

That is, as shown in diagram 8, the excitation-light filter 120 receives white light from the Xe lamp 121, the interference filters 122 and 123 which pass only the excitation light (lambda) 0, on which the interference membrane was deposited, It consists of the colour filter 124 which absorbs light other than excitation-light (lambda) 1 which fits between the interference filters 122 and 123.

【００６７】

Ｘｅランプ１２１より発生した白色光は、干渉フィルタ１２２によりλ０を通過し、λ０以外は反射される。しかしながら、この時λ０以外の光もわずかながら透過する。この透過したλ０以外の光を含む光は、色フィルタ１２４と干渉フィルタ１２３でλ０以外の光が一部カットされるが、干渉フィルタ１２２と干渉フィルタ１２３との間で反射を繰り返すことで、λ０以外の光を色フィルタ１２４で完全あるいは殆ど吸収することができ、効率良くλ０以外の光を抑えることが可能である。

[0067]

White light generated from the Xe lamp 121 passes 0 (lambda) by the interference filter 122, and and it is reflected except for (lambda) 0.

However, at this time, a little bit of (lambda) 0 light still permeates through.

As for the light containing light other than this (lambda) 0 transmitted, a part of the light other than (lambda) 0 is cut by the colour filter 124 and the interference filter 123.

However, the reflection is repeating between interference filter 122 and interference filter 123, thereby light other than (lambda) 0 is absorbed completely or nearly completely by colour filter 124, and it is possible to restrain the light other than (lambda) 0 efficiently.

【００６８】
このように励起光フィルタ１２０を用いることで、λ０以外の光、つまり漏れ光の少ない励起光を得ることができ、励起光源としてのレーザ装置を用いることなく、良好な蛍光観察が可能となる。

[0068]
Thus in other words by using the excitation-light filter 120, light other than zero (lambda) and the low excitation light of the light leakage can be obtained.
A good fluorescent observation can be performed, without using the laser apparatus as an excitation source.

【００６９】

[0069]

【付記】
１）　請求項１に記載の蛍光診断装置であって、前記検出手段は、前記反射光の光量を検出し、前記励起光供給手段は、前記励起光を前記検出手段が検出した前記反射光の光量が最小となる波長に制御する。

[Additional remark]
1) It is the fluorescent-diagnosis apparatus of Claim 1.
Comprising, above-mentioned detection means detects the quantity of light of above-mentioned reflected light.
The quantity of light of the above-mentioned reflected light to which above-mentioned detection means detected above-mentioned excitation light controls above-mentioned excitation-light supply means at the wavelength used as the minimum.

【００７０】
２）　請求項１に記載の蛍光診断装置であって、前記蛍光の複数の波長毎の強度を抽出する抽出手段を備えて構成される。

[0070]
2) It is the fluorescent-diagnosis apparatus of Claim 1.
Comprising, it has extract means which carries out the extract of strength for some of every above-mentioned fluorescent wavelengths, and it is constituted.

【００７１】
このように構成することで、生

[0071]
Thus with constituting, since more extract of the

体組織からの蛍光の強度・波長分布のデータをより多く抽出できるので、正確な蛍光診断を行うことができる。

data of the fluorescent strength * wavelength distribution from an organism tissue can be carried out, exact fluorescent diagnosis can be performed.

【００７２】
３）　生体組織に励起光を照射し、前記生体組織から発生する蛍光により前記生体組織の病変部を診断する蛍光診断装置において、前記蛍光の複数の波長毎の強度を抽出する抽出手段を備えたことを特徴とする蛍光診断装置。

[0072]
3) Irradiate excitation light to an organism tissue..

In the fluorescent-diagnosis apparatus which diagnoses the disease part of the above-mentioned organism tissue according to the fluorescence generated from the above-mentioned organism tissue, it had extract means which carries out the extract of intensity for some of every above-mentioned fluorescent wavelengths.

The fluorescent-diagnosis apparatus characterized by the above-mentioned.

【００７３】
このように構成することで、抽出手段としての回転フィルタ２１ａで生体組織からの蛍光の強度・波長分布のデータをより多く抽出できるので、正確な蛍光診断を行うことができる。

[0073]
Thus with constituting, since more extract of the data of the fluorescent strength * wavelength distribution from an organism tissue can be carried out by rotating filter 21a as extract means, exact fluorescent diagnosis can be performed.

【００７４】
４）　光ファイバ束により物体内部の画像を光信号として伝送する画像伝送装置において、前記光ファイバ束は、所定の波長の励起光により前記光ファイバ束内部で前記光信号を増幅する増幅手段を有し、前記励起光を供給する励起光供給手段と、前

[0074]
4) In the image transmission apparatus which transmits the image inside a body as a light signal by the optical-fibre bundle An above-mentioned optical-fibre bundle has amplification means to amplify the above-mentioned light signal inside above-mentioned optical-fibre bundle by the excitation light of a predetermined wavelength.

記励起光供給手段により供給される前記励起光を前記光ファイバ束に入射する励起光入射手段とを備えたことを特徴とする画像伝送装置。

It had excitation-light supply means to supply above-mentioned excitation light, and excitation-light incidence means which incidents of the above-mentioned excitation light supplied by the above-mentioned excitation-light supply means to the above-mentioned optical-fibre bundle.

The image transmission apparatus characterized by the above-mentioned.

【0075】
このように構成された画像伝送装置では、光ファイバ束としてのイメージガイド45を増幅手段を有したポリマー光ファイバで構成して励起光を導光し、光信号増幅機能を加えることで、イメージインテンシファイヤなしで、微弱な光信号の増幅を可能とする。

[0075]
Thus in the constituted image transmission apparatus, the image guide 45 as an optical-fibre bundle is constituted from the polymer optical fibre with amplification means, and the light-guide of the excitation light is carried out.

By adding light-signal amplification function, amplification of a slight light signal is enabled without an image intensifier.

【0076】
5）　付記4の画像伝送装置であって、前記光信号は、物体内部より発生した蛍光である。

[0076]
5) It is the image transmission apparatus of additional remark 4.
Comprising, the above-mentioned light signal is the fluorescence generated from the inside of a body.

【0077】
6）　付記5の画像伝送装置であって、前記蛍光は、生体組織に集積した蛍光物質あるいは自家蛍光である。

[0077]
6) It is the image transmission apparatus of additional remark 5.
Comprising, the above-mentioned fluorescence is the fluorescent material or the self-fluorescence integrated in the organism tissue.

【0078】

[0078]

この画像伝送装置では、蛍光物質からの微弱な蛍光あるいは自家蛍光を観察することで、蛍光による生体組織観察の操作性や装置の滅菌性を向上させ、正確で安全な蛍光診断を可能とする。

In this image transmission apparatus, it is observing the slight fluorescence or the self-fluorescence from a fluorescent material, and the operativity of the organism tissue observation and the sterilization property of the apparatus by the fluorescence are raised.

Exact and safe fluorescent diagnosis is made possible.

【0079】

7) 付記6の画像伝送装置であって、前記蛍光物質は、少なくとも”ＨｐＤ”，”Ｐｈｏｔｏｆｒｉｎ”，”ＡＬＡ”，”ＮＰｅ$_6$”，”ＢＰＤ”，”ＳｎＥＴ２”のいずれか一つである。

[0079]

7) It is the image transmission apparatus of additional remark 6.

Comprising, the above-mentioned fluorescent material is any one of "HpD", "Photofrin", "ALA", "NPe6", "BPD", "SnET2" at least.

【0080】

8) 付記４、５、６または７のいずれか１つに記載の画像伝送装置であって、前記光ファイバ束は、少なくともＲｈｏｄａｍｉｎｅ ６Ｇ，Ｒｈｏｄａｍｉｎｅ Ｂ，Ｐｅｒｙｌｅｎｅ Ｒｅｄの少なくとも１つを添加することで、前記増幅手段を形成する。

[0080]

8) It is the image transmission apparatus of the additional remarks 4, 5, and 6 or 7 any one description.

Comprising, the above-mentioned optical-fibre bundle is adding at least one Rhodamine 6G, Rhodamine B, Perylene Red at least, and forms above-mentioned amplification means.

【0081】

9) 付記４、５、６、７または８のいずれか１つに記載の画像伝送装置であって、前記励起光源は、ＹＡＧレーザ，半導体レーザ，アルゴンレーザ，エキシマレーザのいずれか一つであ

[0081]

9) It is the image transmission apparatus of the additional remarks 4, 5, 6, and 7 or 8 any one description.

Comprising, the above-mentioned excitation source is any one of, a YAG laser, a semiconductor laser, an argon laser, and the

る。

excimer laser.

【００８２】

１０）　先端側に湾曲可能な湾曲部を備えた体腔内に挿入する挿入部を有し、前記挿入部先端に位置する体腔内組織からの蛍光を検出する内視鏡と、前記湾曲部を湾曲させる湾曲手段と、前記内視鏡により撮像された前記蛍光より前記体腔内組織の病変部を検出する病変部検出手段と、前記体腔内組織の前記病変部を検出する前記検出手段の出力に基づいて、前記湾曲手段を制御する湾曲制御手段とを備えたことを特徴とする内視鏡装置。

[0082]

10) It has an insertion part inserted in the intra-corporeal equipped with the curved part which can curve to the end side.

The endoscope which detects the fluorescence from the intra-corporeal tissue positioned at the above-mentioned end of an insertion part, and curvature means to curve the above-mentioned curved part, the above-mentioned fluorescence recorded by the above-mentioned endoscope, disease part detection means to detect the disease part of the above-mentioned intra-corporeal tissue, and curvature control means to control above-mentioned curvature means based on the output of above-mentioned detection means to detect the above-mentioned disease part of the above-mentioned intra-corporeal tissue

These were equipped.

The endoscope apparatus characterized by the above-mentioned.

【００８３】

このように構成された内視鏡装置では、病変部検出手段としての蛍光診断処理部１０６が体腔内組織からの微妙かつ微少な蛍光の違いに基づいて病変部を検出し、湾曲制御手段としてのアングル制御部１００が湾曲手段としての電動アングル９８を制御し、病変部が内視鏡視野の所定の位置にくるように湾曲部を湾曲させることで、操作性を向

[0083]

Thus in the constituted endoscope apparatus, the fluorescent-diagnosis processor 106 as disease part detection means detects a disease part based on the delicate and very small fluorescent difference from an intra-corporeal tissue.

The angle control part 100 as curvature control means controls the electrically driven angle 98 as curvature means.

While raising operativity by curving a curved part so that a disease part may come to the

上させると共に確実な病変部の検出を可能とする。

position of an endoscope visual field, the detection of a reliable disease part is made possible.

【００８４】

１１） 付記１０の内視鏡装置であって、前記蛍光は、生体組織に集積した蛍光物質からの蛍光あるいは自家蛍光である。

[0084]

11) It is the endoscope apparatus of additional remark 10.

Comprising, the above-mentioned fluorescence is the fluorescence or the self-fluorescence from a fluorescent material integrated to the organism tissue.

【００８５】

１２） 付記１０または１１の内視鏡装置であって、前記病変部検出手段は、２つ以上の波長領域の蛍光の強度を抽出することにより前記病変部を検出する。

[0085]

12) It is the endoscope apparatus of additional remarks 10 or 11.

Comprising, above-mentioned disease part detection means detects the above-mentioned disease part by carrying out the extract of fluorescent strength of the wavelength area more than two.

【００８６】

１３） 付記１０、１１または１２のいずれか１つに記載の内視鏡装置であって、前記湾曲制御手段は、前記病変部が前記内視鏡の視野の中央に来るように前記湾曲手段を制御する。

[0086]

13) It is the endoscope apparatus of any one description of the additional remarks 10, 11, or 12.

Comprising, as for above-mentioned curvature control means, the above-mentioned disease part controls above-mentioned curvature means so that the visual field of the above-mentioned endoscope comes central.

【００８７】

１４） 付記１０、１１、１２または１３のいずれか１つに記載の内視鏡装置であって、前記湾曲手段は、少なくとも１つ以

[0087]

14) It is the endoscope apparatus of any one description of the additional remarks 10, 11, 12, or 13.

Comprising, above-mentioned curvature means

上のアングルワイヤと、電動モータとから構成される。

consists of the angle wire of at least one, and an electric motor.

【０　０　８　８】

[0088]

【発明の効果】

以上説明したように本発明の蛍光診断装置によれば、励起光供給手段が、検出手段の出力に基づいて、供給する励起光の波長を制御するので、簡単な構成により、生体組織の部位、状態によらず、効率的かつ正確な蛍光診断を行うことができるという効果がある。

[EFFECT OF THE INVENTION]

Since excitation-light supply means, as explained above, controls the wavelength of the excitation light to supply, based on the output of detection means according to the fluorescent-diagnosis apparatus of this invention, by simple composition, regardless of the organism tissue, and its state, efficient and exact fluorescent diagnosis can be performed.

The above-mentioned effect is expectable.

【図面の簡単な説明】

[BRIEF EXPLANATION OF DRAWINGS]

【図１】

第１実施例に係る蛍光観察内視鏡装置の構成を示す構成図。

[FIGURE 1]

The block diagram showing the composition of the fluorescent observation endoscope apparatus based on the 1st embodiment.

【図２】

図１の蛍光観察内視鏡装置により励起光λ０を照射した時の体腔内組織の蛍光特性を示す特性図。

[FIGURE 2]

The characteristic view showing the fluorescent characteristic of the intra-corporeal tissue when irradiating excitation-light (lambda)0 with the fluorescent observation endoscope apparatus of diagram 1.

【図３】

第２実施例に係る蛍光観察内視鏡装置の構成を示す構成図。

[FIGURE 3]

The block diagram showing the composition of the fluorescent observation endoscope apparatus based on the second embodiment.

【図４】
図３の回転フィルタの構成を示す構成図。

[FIGURE 4]
The block diagram showing the composition of the rotating filter of diagram 3.

【図５】
イメージ・インテンシファイヤなしで蛍光診断を行うことのできる一実施例の蛍光観察内視鏡装置の構成を示す構成図。

[FIGURE 5]
The block diagram showing the composition of the fluorescent observation endoscope apparatus of one embodiment which can perform fluorescent diagnosis without an image * intensifier.

【図６】
図５の蛍光観察内視鏡装置の変形例の構成を示す構成図。

[FIGURE 6]
The block diagram showing the composition of the modification of the fluorescent observation endoscope apparatus in the diagram 5.

【図７】
微妙かつ微少な蛍光の違いを検出し患部のある所でアングルを止める蛍光観察内視鏡装置の一実施例の構成を示す構成図。

[FIGURE 7]
The block diagram showing the composition of one embodiment of the fluorescent observation endoscope apparatus which stops an angle in the place which detects a delicate and very small fluorescent difference, and has a diseased part.

【図８】
Ｘｅランプの白色光より励起光を効率良く選び出す励起光フィルタの構成を示す構成図。

[FIGURE 8]
The block diagram showing the composition of the excitation-light filter which selects excitation light out of white light of Xe lamp efficiently.

【符号の説明】
１…内視鏡
２…第１アダプタ
３…通常照明光源
４…蛍光用レーザ装置
５…第２アダプタ

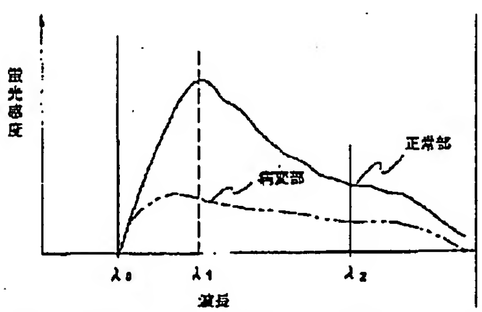
[EXPLANATION OF DRAWING]
1... endoscope
2... The 1st adapter
3... usual illumination light source
4... Laser apparatus for fluorescence
5... second adapter

6…通常ＴＶカメラ
7…蛍光像撮像カメラ
8…ＣＣＵ
9…蛍光画像処理装置
１０…ビデオスイッチングコントローラ
１１…ビデオスイッチャ
１２…モニタ
１３、１８…ドライバ
１４、１９…可動ミラー
１５…ライトガイド
１６…イメージガイド
２０、２３…ＣＣＤ
２１…回転フィルタ
２２…Ｉ．Ｉ
２５…タイミングコントローラ
２７…反射光モニタ
２８…移動手段

6... usual TV camera
7... fluorescence image image-pick-up camera
8...CCU
9... fluorescence image processing device
10... video switching controller
11... video switcher
12... monitor
13 and 18... Driver
14 and 19... Movable mirror
15... light guide
16... image guide
20, 23...CCD
21... rotating filter
22...I.I
25... timing controller
27... reflected-light monitor
28... movement means

【図２】

[FIGURE 2]

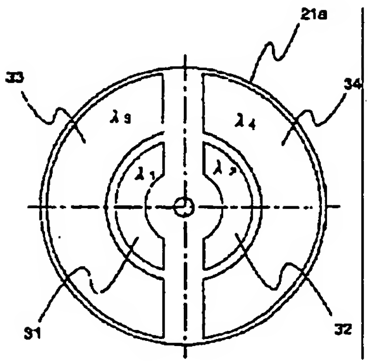


[translation of Japanese text in Figure 2]

vertical axis: fluorescent sensitivity
horizontal axis: wavelength
upper line: normal
lower line: diseased part

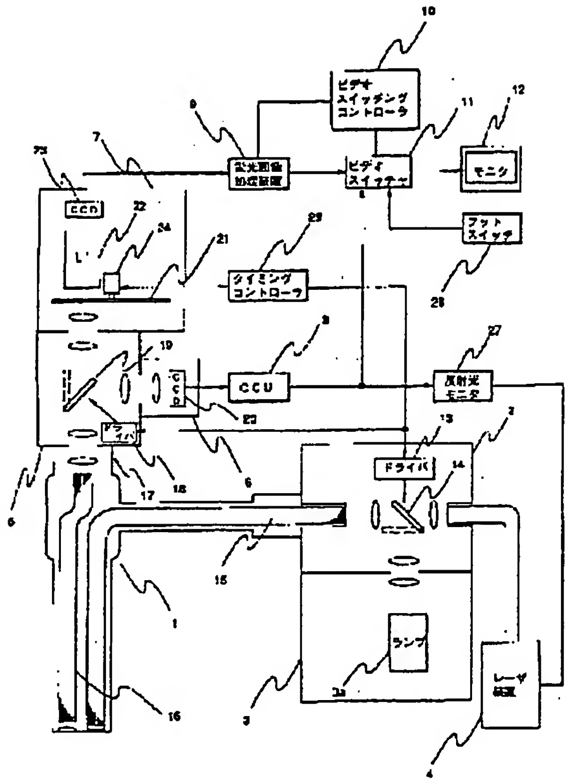
【図４】

[FIGURE 4]



【図１】

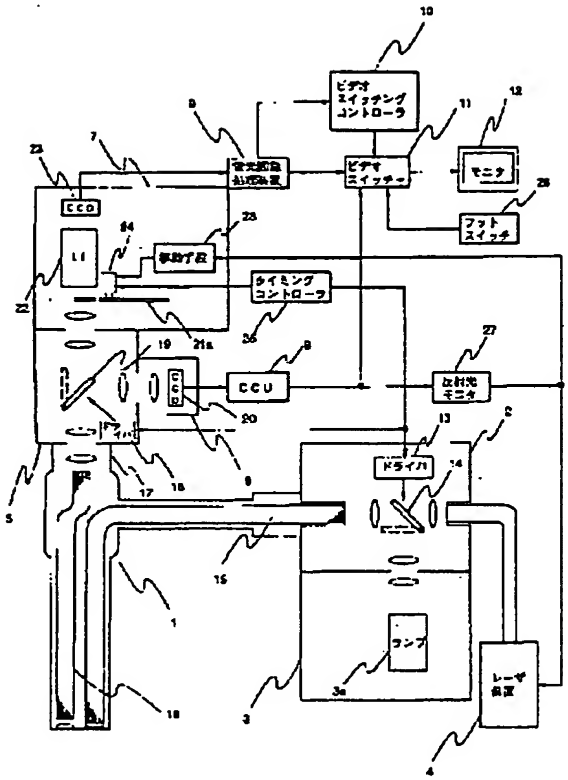
[FIGURE 1]



[translation of Japanese text in Figure 1]

3a	lamp
26	foot switch

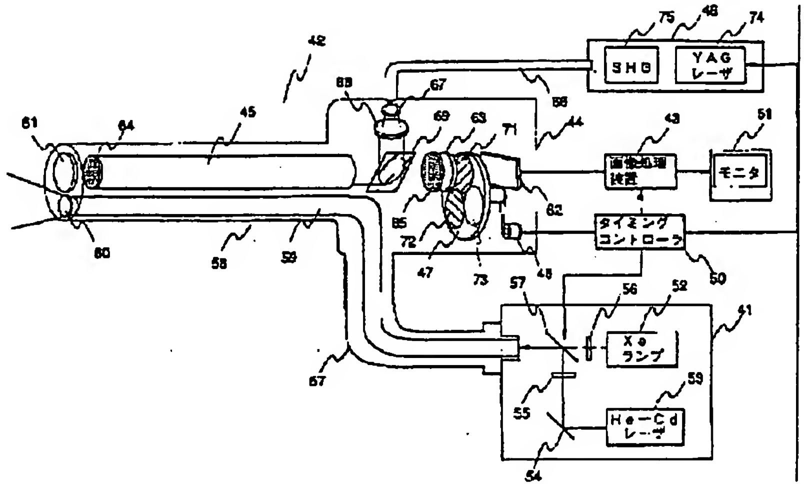
【図3】 **[FIGURE 3]**



[translation of Japanese text in Figure 3]

3a	lamp
26	foot switch

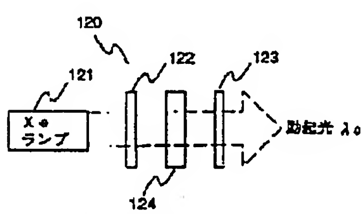
【図５】 **[FIGURE 5]**



[translation of Japanese text in Figure 5]

43	image processor
50	timing controller
51	monitor
52	Xe lamp
53	He-Cd laser
74	Yag laser

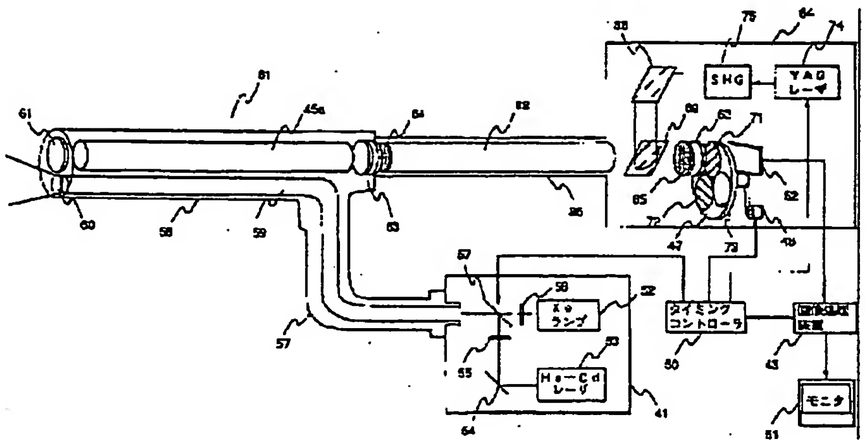
【図8】 **[FIGURE 8]**



[translation of Japanese text in Figure 8]

121	Xe lamp
output	excitation light lambda$_0$

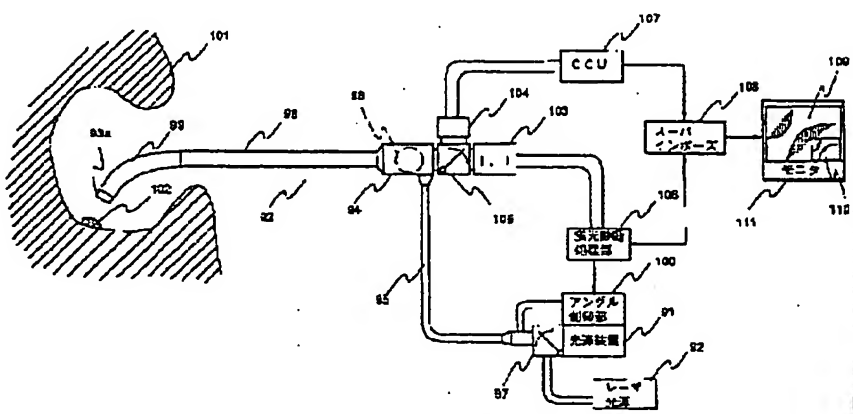
【図6】 **[FIGURE 6]**



[translation of Japanese text in Figure 6]

43	image processor
50	timing controller
51	monitor
52	Xe lamp
53	He-Cd laser
74	Yag laser

【図7】 **[FIGURE 7]**



[translation of Japanese text in Figure 7]

91	light source